The Chemical Age

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Notes and Comments

Solvents in Industry

THE war has left us many legacies, mostly bad, but some good. Amongst its few benefactions has been the rise of new industries, not the least important of which is the manufacture of solvents. The necessity for "doping" aeroplane wings with cellulose esters which was later followed by the use of cellulose lacquers for motor cars and finally the application of these lacquers to house decoration and furniture, has intensified the demand and is leading to a revolution in the methods of the painter and varnisher which makes it difficult to foresee a limit to the manufacture of solvents. That, of course, is only one of the uses to which solvents are being put. Not only has the extent to which solvents are put been extended within recent years, but the number available has also increased greatly.

It is a noticeable fact that whereas we were formerly dependent wholly upon the simpler organic compounds, such as alcohol, ether, benzene, and so forth, we now find some of our most valuable solvents among the more complex organic bodies. Naphthalene, for example, does not appear to hold much promise in regard to its solvent properties, but 1-2-3-4 tetrahydronaphthalene—better known as "tetralin," a product of the partial catalytic hydrogenation of naphthalene—is a valuable solvent; it is used for oils, resins, waxes, rubber, cumarone, colophony, mastic and asphalt, but it does not dissolve the cellulose esters or bakelite. It was found, however, that "tetralin" suffered from one disadvantage; it oxidises on exposure to air as does turpentine. Further research showed that by carrying the hydrogenation to completion and forming the deca-compound, now known as "decalin," a still more complex compound was formed which, though not quite so powerful a solvent, did not oxidise. This example illustrates the possibilities and the limitations of existing solvents. There is no solvent of which it can be said that perfection has been reached. In every instance it *may* be possible to find one better, and therein lies the field for continuous research.

Fundamental Requirements

SIX characteristics are of fundamental importance in solvents; they are solvent power, volatility, stability, toxicity, inflammability, and colour. Unless in every respect the solvent selected is perfect, it cannot be said that the summit of perfection has been reached. Unfortunately it too frequently happens that a change for the better in one direction adversely affects one or more of the other properties. Whilst it is true that a solvent is essentially "a substance by which a solid may be brought into the fluid state," this definition hardly expresses the whole truth, since in so large a field as that of paints and varnishes the solvent merely provides a means of transferring a solid from one place to another in a convenient way; it is not only the characteristics mentioned above that are important, but also that of disappearing as quickly as possible after use and of leaving behind the solid deposited in the desired perfection of surface and brilliance of lustre.

Thus the search for solvents continues in the endeavour to decrease price or to increase the degree of perfection attained, and the complexity of the substances used increase. Ethyl lactate, ethyl glycol and epiethylin are all of actual or potential interest for cellulose esters. Cyclohexanol is another solvent of complex constitution. There is a large group of solvents that contain chlorine; carbon tetrachloride and chloroform are the older ones, tri- and tetrachlorethane are the newer ones. There is a vast number of derivatives of the aliphatic alcohols, too numerous to mention individually, some of which are being made in this country at the rate of thousands of tons a year. As an example of a solvent which—though used also for other purposes—has come into use recently, furfural may be cited; within less than 10 years the price of this chemical dropped from some £6 per lb. to 5 pence per lb., solely on account of the stimulation of industrial demand.

Some New Starting Points

NOT only is the demand stimulating research to discover new solvents, but it is also causing investigation to be made into the possibility of turning existing sources into raw material for solvent production. The derivatives of amyl, propyl and iso-butyl alcohols, for example, are dependent for the supply of their raw materials upon the production of fusel oil as a by-product in the manufacture of alcohol, but since this is limited an alternative source of supply is needed. A paper by J. E. Osterrieth, presented to the Institute of Fuel in 1933, disclosed the developments in Belgium in manufacturing a range of chemical products from coke oven gas. The carbon monoxide is converted by addition of hydrogen into methyl alcohol; the methane is converted into carbon monoxide and thence into the same compound; ethylene serves as the basis for production of ethyl alcohol; the mixed ethyl and iso-propyl

alcohols are converted into acetone. From these products as starting points a wide range of products becomes possible—formaldehyde and its derivatives, tri-oxymethylene hexamine, synthetic resins, etc.; there is also acetaldehyde, metaldehyde, and various acetate solvents; acetone can be rehydrogenated into iso-propyl alcohol or converted into diaceto-alcohol and other solvents. Unfortunately colliery owners in this country have not yet proved sufficiently progressive to tackle the manufacture of chemicals from coke oven gas. It is significant that already interesting solvent properties have been shown to be possessed by some of the products of hydrogenation of coal. It would be interesting, and not altogether unlikely, if the hydrogenation plant at Billingham should ultimately produce a wide range of chemical products instead of the straight petrol for which it is now intended.

Water was termed "the universal solvent." We have progressed far from those days. No longer are we satisfied to use solvents solely as solvents. Their use in painting and decorative work is far more intricate. Shall we come to a time when solvents are used throughout our daily life to a much greater extent? Already we "dissolve" our meat, our Oxo, and our Bovril; dissolved food is more assimilable than the solid variety. Will our doctors presently demand that we take everything in liquid form, or, more likely, will our womenfolk demand that nothing shall be expected of them in the culinary department save to pour boiling solvent over a tablet of prepared food?

A Clear Lead

ON Sunday last, we learnt that 80 Bulgarian generals, impatient at the party haggling which had prevented the Premier from forming a new executive, by a bloodless coup d'état, had forced the King to sign a decree appointing a non-party Government, or practically to establish a dictatorship. This is the action we need to take in chemistry. Our chemical army has no 80 generals and the few we have seem to be without revolutionary ardour: still, it should be possible for industry to muster eight men of substance to act together and follow the Bulgarian example. Let them insist on an end being put to the intolerably protracted haggling between the various recalcitrants and on steps being taken, without further delay, to bring all interests under one central government. If this cannot be done willingly, an "Order in Council" should be obtained to that end. We hope soon to hear that telephone messages have been sent to some of the professors and others, telling them that they are deposed from office. Let the charters of their societies be impeached, if necessary: these have long ceased to have any meaning and at most they are fit to be framed and glazed and displayed among the fossils at South Kensington, as relics of a bygone age.

In Bulgaria, the peasants who form 80 per cent. of the population have been neglected; here the interests of far more than 80 per cent. of those directly concerned with chemistry are at stake. Let us recognise that the day for individual glorification and the promotion of cliques at the expense of the body politic is past. The call to lighten the burden upon the younger generation is imperative; still greater is the call for the unification of the profession. If chemists did their duty, probably a large proportion of the men now practising medicine would be unnecessary. As it is, the medical profession is listened to by the public; the voice of the chemist is unheard. Chemists should be the controllers of the world; the health of the community will be primarily in their hands. The public knows them only as pill-rollers; Professor Robinson was so capped recently at Madrid. What is the chemist doing in public to-day to make himself respected, to prove his value? He talks a language that he does not himself understand about things that for the most part are of little concern to anyone. He offers no advice upon subjects of real public concern. Smashing atoms and manufacturing new elements that last only a few minutes will not carry him far. The public will soon ask for some more direct contribution to the world's affairs. It were time that he gave some thought to his position in the community; that he realise that he has a public duty, and must make himself worthy to be heard.

Dangerous Dust

A FURTHER stage in a long process of investigation and discovery will be reached this month when an international meeting is held at Geneva to draw up a preliminary charter which shall secure compensation for those who have suffered damage as a consequence of inhaling silica dust. Medical science has been conscious for many years that persons engaged in certain occupations are more liable than their fellows to contract tuberculosis. This knowledge was increased in the first instance by recognition of the fact that dangerous occupations tend to be occupations in which dust is inhaled by the worker. Later it was shown that the quality of dust determines its effect. Coal dust does not appear to be associated to any great extent with tuberculosis; silica dust or rock dust, on the other hand, is very closely associated with that disease. For a time the view prevailed that the bad quality of silica dust was its roughness. This sharp, gritty dust, it was suggested, inflicted injury on the lungs by cutting or tearing them. Further work dispelled this idea. It is known now that silica dust is dangerous as a chemical and not as a physical agent. The dust acts as a third partner in disease. It appears to reduce bodily resistance to tuberculosis so that in its presence the normal efforts of the body to protect itself became ineffective.

The study of silica dust led to a study of asbestos dust. There may be other outstandingly dangerous dusts, though their detection by the means of observing their evil effect is likely to be a long and painful process. In these circumstances great interest attaches to work now being carried on to determine whether or not any special chemical quality distinguishes dangerous from harmless dusts. Dr. W. R. Jones has suggested that a silicate of potassium and aluminium called "sericite" may be of the special quality and has offered evidence in support of his view. At the same time Professor E. H. Kettle has evolved a method of detecting dangerous qualities in dusts. These are steps of great importance. Disease, it is becoming evident, is not as a rule a simple association of man with microbe, but rather a system built up of different elements in which and through which the attack of the microbe becomes effective.

Solvent Recovery by the Carbon Adsorption Process

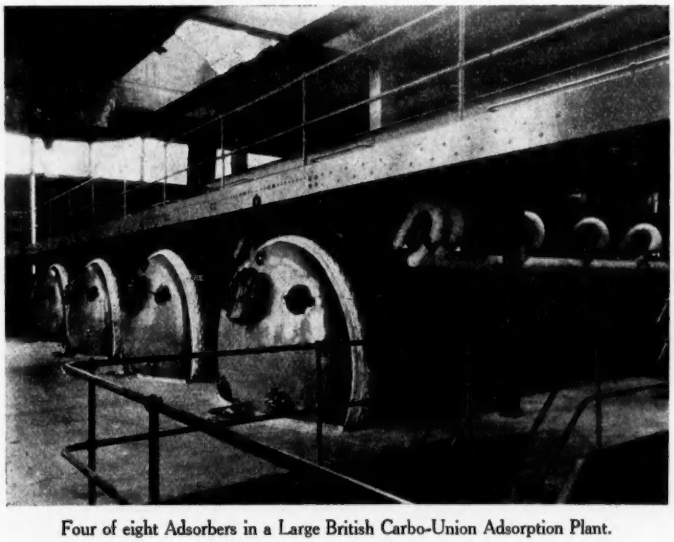
By HUGH GRIFFITHS, B.Sc., M.I.Chem.E., A.R.C.Sc.

(Director of British Carbo-Union, Ltd.)

SINCE the carbon adsorption process was first developed industrially by one of the members of the Carbo-Union, altogether 250 plants have been installed, the total quantity of solvent recovered in these Carbo-Union plants during the year 1933 amounting to 460,000,000 lb. A large proportion of these plants are of substantial size, and it is perhaps not to much to say at the present time that owing to the pioneering work of British Carbo-Union and its associated firms, the carbon adsorption process has been adopted in a large proportion of cases where the amount of solvent which is used is relatively large and the materials to be dealt with are such as can be recovered easily.

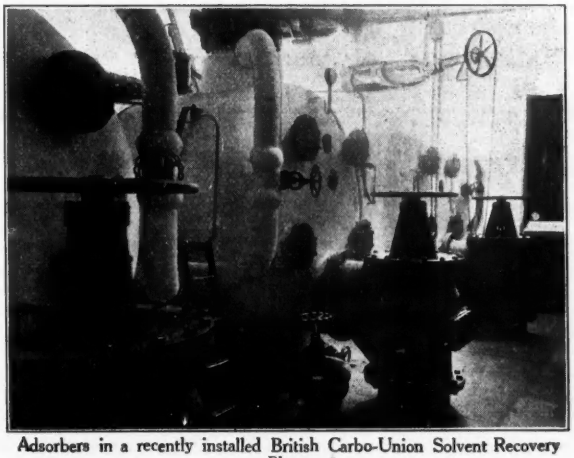
In the rubber industry, for example, the recovery of solvent naphtha by the carbon adsorption process is now one of the simplest of all recovery operations, and as the result of the co-operation with rubber manufacturers whereby they have become conscious of the economies which can be secured with an efficient recovery plant, it is now possible to construct plants which give practically quantitative recovery. Plants are now in operation which have shown 95 per cent. recovery of solvents calculated on the total amounts actually used. When it is borne in mind that in the rubber industry a certain proportion of the solvent is still left in the materials which have been treated with the rubber solutions it will be recognised that not only does the carbon adsorption system afford a method of almost quantitative removal of solvent vapours from air, but also that the design of collecting devices has been brought to a state of perfection.

It must be borne in mind, however, that the recovery of solvents from most rubber works operations is one of the simplest of all applications of the carbon process. The solvent is comparatively inert and does not tend to undergo catalytic oxidation or polymerisation. It is furthermore practically insoluble in water and may be separated from the condensate obtained from the desorption process very easily. It is, therefore, not surprising to find that the rubber industry has been fairly quick to adopt carbon adsorption plants for the purpose of recovering the solvents used in that industry.



Four of eight Adsorbers in a Large British Carbo-Union Adsorption Plant.

Among the earlier plants which were supplied were also those for the recovery of acetone from such manufactures as artificial silk, explosives and other cases in which cellulose ester-solutions are employed. In the case of artificial silk factories the cost of solvent is a very critical factor of manufacturing cost. The quantities to be recovered are usually large and it is natural that the manufacturer of artificial silk should look for the highest possible efficiencies. In this class of work it has been possible to reach consistently recovery efficiencies of 99.3 to 99.6 per cent. It may be worth while to mention, however, that even in these cases modifications of design were found to be necessary in view of the fact that acetone is not absolutely inert from a chemical point of view.



Adsorbers in a recently installed British Carbo-Union Solvent Recovery Plant.

During the last few years careful investigations have been made of a large number of industrial processes in which solvents have to be recovered which are not so easily and directly obtainable from the adsorbers as in the above-mentioned cases. For example, in many special processes relatively complex mixtures have to be vaporised and adsorbed together. In some cases 5 or 6 different components may be used, some of which may be soluble in water and others immiscible. It has also been necessary to investigate the effect of different special solvents upon the life of various grades of adsorptive carbon, and it has been found that in practically all cases it is essential, if the best efficiency is to be secured, to employ carbons of low retentivity. The manufacture of carbons of carefully graduated adsorptive and retentivity characteristics is considered to be one of the most important of the advances made during the past few years.

The separation of the solvent from the distillates obtained from the recovery plants has required some very careful investigations, but even in cases where constant boiling mixtures have been encountered the separation problems have been mastered. It is believed that when chemical manufcturers came to realise more clearly the progress which has been made in the carbon adsorption process, they will not only pay great attention to the possibilities of recovery, but will also design the plants which they use, with greater attention to the possibilities of recovery.

In many manufacturing operations practically quantitative recovery of solvents could be obtined if the plant had been originally designed with solvent recovery in mind. Far too often, however, the chemical plants are designed to meet a profitable demand and at the outset the loss of solvent is considered to be inevitable, and in any case not important so long as a high price for the products can be obtained. Sooner or later competition arises and the chemical manufacturer then turns his attention to the subject of solvent recovery, with the result that either modifications have to be introduced into

the original plant or the conditions of recovery are such as to make the recovery installation more expensive than would have been necessary if due regard had been paid to recovery at the outset.

A further interesting example which will indicate the progress made by the carbon adsorption process may be given from the gasoline and benzole industries. One of the first important applications of the carbon adsorption process was the extraction of gasoline from natural gas. Many very large installations have now been erected and the process has been brought to a state of technical perfection. On introducing this technique into the coal gas industry, however, an entirely new series of problems had to be solved. It was found at first that the carbon lost its activity very rapidly, and it was only after a considerable amount of research into the production of carbons of low retentivity and the various factors which influence polymerisation and fouling of the carbon by impurities that a satisfactory solution was obtained. The carbon adsorption process has to its credit the largest benzole extraction plant in the world, this process being employed at the Beckton Gasworks where approximately 20,000 gallons of benzole per day are extracted from 77,000,000 cubic feet of gas.

A further direction in which careful investigations have led to improvements in carbon adsorption recovery plants is towards safety of operation. It is frequently stated that so long as a sufficiently large volume of air can be employed to dilute the air solvent mixture not only will efficient recovery be secured, but that increased safety will be assured. It is not to be overlooked, however, that in some cases the fluctuations in the rate of vaporisation are very great, and in several recent plants not only have special precautions been taken to maintain the composition of the air-solvent mixture very much below the lower explosion limit, but additional precautions have been taken so that danger of flame propagation, even under the most abnormal conditions, can at all times be obviated.

It is perhaps correct to say that the carbon adsorption process is now so firmly established that it may be regarded as the most important of all processes of solvent recovery. Recent progress has been more in the direction of securing improvements to facilitate practical operation and to extend the applicability of the process to industries in which solvent recovery processes have not hitherto been easily applied, and generally to develop the designs so that in most cases high efficiency can be maintained, not merely when the plant is first installed, but after the installation has been in operation for a period of years.

Chlorinated Ethanes and Ethylenes

A Useful Range of Non-Inflammable Solvents

MANY organic solvents commonly used for dissolving or extracting oils, fats, waxes and resins, for dry-cleaning, or for metal degreasing, have the serious disadvantage of inflammability, and practically all lacquers contain either solvents or diluents of the comparatively low-boiling class, such as acetone, alcohol, ethyl acetate, benzene, toluene and ligroin, whose flash-points range over normal temperatures. It is impossible entirely to eliminate the fire risks attending the use of such solvents, and elaborate precautions are in any case necessary to minimise them. There are the further disadvantages of vexatious restrictions imposed upon the storage and transport of inflammable materials, and the high premium for fire insurance of works using them. These inflammable solvents may be replaced in many cases by one or other of a series of chlorinated hydrocarbons, which form non-inflammable volatile liquids of exceptional solvent power, and which are becoming increasingly popular in many industries to-day.

The manufacture in this country of these chlorine derivatives of ethane and ethylene by the progressive and controlled chlorination of acetylene has, since 1903, been centred at the Runcorn factory of the Castner-Kellner Alkali Co., now a subsidiary company of Imperial Chemical Industries, Ltd. The boiling points of the five individual members of the series, which form liquids at ordinary temperatures range from about 52° C. to 159° C.—a range whose amplitude is not approached by any other group of solvents—and their chief physical constants are given in the accompanying table.

The main point of difference between each member of the series is seen to be the remarkably useful one of boiling point, so that a choice is offered of any solvent of similar properties from a wide range of volatilities. There are, however, some other individual properties which it may be useful to note. Tetrachlorethane ($CHCl_2-CHCl_2$) is the parent compound and the most generally powerful solvent of the whole series. Tetrachlorethane is toxic, and thus its industrial use is restricted by general consent to those special cases where its properties make it essential, and where adequate precautions can be taken. Formerly known under the name of "Westron," this liquid is non-inflammable, like all its congeners, and is a powerful solvent for almost all oils, fats, waxes and resins, as well as for bitumen, rubber, caoutchouc, and tarry substances. Since it readily dissolves cellulose acetate and nitrate, it is usefully employed as a diluent for reducing the inflammability of lacquers. The common metals are not attacked by the anhydrous solvent, although only lead and tin are free from attack in the presence of moisture. Aluminium is stated to be particularly susceptible to attack. The use of tetrachlorethane during the war for aeroplane dope gave rise to many fatal cases of toxic jaundice, and its employment for industrial purposes is now discouraged.

Dichlorethylene ($CHCl=CHCl$), as prepared commercially, is a mixture of the two stereoisomers—the "trans" form, usually present to the extent of about 40 per cent., boiling at 48° C., and the "cis" form, boiling at 60° C.—and does not, therefore, possess a constant boiling point. The hot vapours of sym-dichlorethylene can actually be ignited, but they burn with a cold flame which will extinguish itself, and it is found that there is no danger from fire under the conditions in which it is used in industrial practice. It is

Name.	*Sym-Dichlorethylene.*		*Trichlor-ethylene.*	*Sym-Perchlor-ethylene.*	*Tetra-chlor-ethane.*	*Penta-chlor-ethane.*
	Cis.	*Trans.*				
Formula	$C_2H_2Cl_2$	—	C_2HCl_3	C_2Cl_4	$C_2H_2Cl_4$	C_2HCl_5
Molecular weight	96.9	—	131.4	165.8	167.8	202.3
Boiling-point (760 mm.)	59.8° C.	48.8° C.	87° C.	121.1° C.	146.2° C.	162° C.
Vapour pressure (20° C.)	About 205 mm. Hg.	—	56 mm. Hg.	17 mm. Hg.	11 mm. Hg.	7 mm. Hg.
Specific heat (20° C.)	0.270	—	0.223	0.216	0.268	0.266
Latent heat (calculated)	71 cal.	—	56.59 cal.	51.59 cal.	54.43 cal.	43.64 cal.
Freezing point	−80.5° C.	−50° C.	−73° C.	−19° C.	−36° C.	−22° C.
Specific gravity (15° C.)	1.278	—	1,476	1.624	1.6011	1.685

used with success in the laboratory to replace low-boiling, highly inflammable solvents such as ether, being moreover much more easily dried, since water is only very slightly soluble in it. It is also most satisfactory for the extraction of delicate perfumes, whose odours would be affected by too high a temperature, and it is probably the best solvent known for rubber. Its use for power production in multiple vapour power plants has been suggested, and is now under investigation. Heating with alkalies is stated to cause the liberation of the spontaneously inflammable chloroacetylene, but it may be used with safety in contact with all the common industrial metals.

Trichlorethylene ($CHCl=CCl_2$) is by far the most important member of the group, and most nearly complies with all the demands made on the ideal solvent. The commercial product is a pure substance, whose boiling range lies within 1° C., and which exerts a powerful solvent action on practically all kinds of oil and grease, as well as on cumarone, rubber, bitumen, sulphur and resins. Certain vegetable oils, however, such as linseed oil, and substances of the carbohydrate, glucoside, and tannin types do not dissolve in it. Trichlorethylene is a most useful extracting agent for a very wide range of materials: by virtue of its powerful solvent action, low surface-tension and remarkable penetration, complete "wetting out" is rapidly effected, while its relatively low latent and specific heats play an important part in reducing evaporation and recovery costs to a minimum. It has applications in a variety of industries apart from what is perhaps its most important industrial use, namely, the degreasing of metals and machinery in general. These miscellaneous applications include its use as a dry cleaning and extracting agent, as a general solvent in organic chemical investigations, and in the preparation of paint and tar removers, rubber cements and solutions and insecticides.

Of the two remaining solvents of the group, pentachlorethane ($CHCl_2—CCl_3$) is similar in its chemical and solvent properties to tetrachlorethane, and is sometimes used to replace the latter where a higher boiling solvent is required. Both tetra- and pentachlorethane are reduced to di- and trichlorethylene respectively by the common metals other than lead and tin in the presence of moisture. The commercial product usually contains a trace of hexachlorethane. It is a good solvent for cellulose acetate and some resins. Perchlorethylene ($CCl_2=CCl_2$) resembles trichlorethylene in that it does not attack metals to any appreciable extent, even in the presence of moisture. As a solvent also, it possesses similar properties to trichlorethylene, but the pure substance is more expensive. It may usefully serve to lower the volatility of trichlorethylene (but not its solvent power) by admixture to the extent of 50 per cent. or more, and it is stated to be finding increased use in dry-cleaning and in the manufacture of certain solvent soaps.

Oil and Fat Extraction

Trichlorethylene has been used successfully for oil extraction for 20 years, during which time its manufacture has been greatly improved, and the introduction of the pure, constant-boiling product as at present marketed did much to stimulate this particular application. The many materials commercially extracted by the chlorhydrocarbons for the winning of valuable animal and vegetable oils and fats includes waxes, resins, bones, leather, fish, offal and animal and vegetable residues from various sources. Since the rate of solution of trichlorethylene increases with temperature, most extractions are carried out with the aid of heat, the most suitable temperature being determined by experiment. Besides preventing the extraction by the oil itself of non-fat impurities, extraction by trichlorethylene has been found to give oils which may be obtained free from the last traces of solvent without undue heating and consequent damage. So as to obtain maximum efficiency in the extraction of solids, the material is usually in the form of thin flakes or shavings, which assist solvent action by presenting maximum surface with minimum thickness and, by providing interstices, giving ready penetration. Air should be removed from the material and where means are provided in the plant for reversible circulation of the solvent, better extraction takes place, and channelling is avoided.

As an extracting agent, trichlorethylene is at least as efficient as carbon tetrachloride or benzine, and is safer than either. It should be remarked that it is not usually economical to remove the last ½ per cent. to 2 per cent. of oil from the residue. Oils extracted in this way may be refined by the same methods as oils obtained by expression, either by charcoal or silicates.

Fumigation and Disinfection

Reports of the use of ethylene dichloride/carbon tetrachloride mixtures for the fumigation of foodstuffs in America emphasise that all the chlorinated hydrocarbons have insecticidal properties by reason of the narcotic effects of their vapours at comparatively high concentrations. Tetrachlorethane has long been recognised by the Ministry of Agriculture and Fisheries as the standard agent for controlling white-fly in glass houses, and it is much used for this purpose. It is not yet fully realised that the chlorethylenes have germicidal properties which make them excellent antiseptics, and within the last few years, trichlorethylene has been definitely proved to be excellent for cleaning dirty wounds prior to dressing. Soaps of the "Westropol" type can also lay claim to mild germicidal properties.

Chemical Stability

The increasing use of these non-inflammable solvents in many industries has naturally focussed attention on their stability under industrial conditions. This applies particularly to trichlorethylene, the most extensively used of the chlorhydrocarbons. Recent investigations which have been carried out along the two main lines along which decomposition of trichlorethylene may proceed—those of photochemical and thermal decomposition—have shown that the solvent takes 160 days to develop 0.5 normal acidity in colourless glass, and that no acidity is developed on boiling in vessels of mild steel for 72 hours, even with an outside bath at 160° C., some 80° C. above the boiling-point of pure trichlorethylene.

It is customary to add to trichlorethylene, as sold for degreasing purposes in England, a small amount of a basic stabilising compound (usually an alkylamine) which is able to neutralise any acid which may be formed should decomposition occur. The results of a series of laboratory tests in which all the standard degreasing conditions were reproduced, and which covered a range of eleven different metals commonly used in construction or treated in degreasing processes, showed that out of 220 cases investigated only 61 cases of corrosion greater than 0.1 mm. per year occurred. Of these only eight occurred with pure trichlorethylene, and only five with the stabilised solvent. The decomposition of trichlorethylene is principally dependent on exposure to light, a condition which does not obtain in degreasing plants, and which storage conditions and stabilisation can readily be designed to prevent. The construction of plants for the use of tri- and perchlorethylene involves very little restriction in the choice of materials and is usually of heavy galvanised iron; there is thus no difficulty in constructing plant for these solvents at a reasonable cost, in contrast to the costly installations required by carbon tetrachloride, for example.

Hygienic Precautions

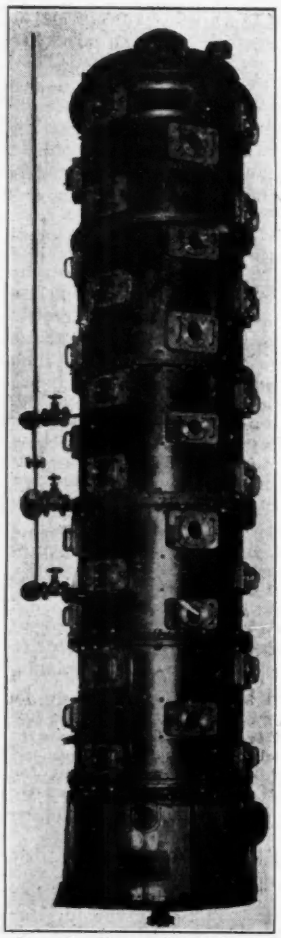
The question of the toxicity of the chlorinated solvents has been the subject of many vague and conflicting rumours for some time past, and it seems possible that with increasing industrial use, undue emphasis has come to be laid on a property possessed by almost all organic liquids to a greater or less extent. Tetrachlorethane is definitely the most toxic of the chlorinated solvents, both it and benzene being listed as dangerous solvents, and diseases arising from their use are legally notifiable under the Workmen's Compensation Act. In most cases, perchlorethylene can be adequately substituted for tetrachlorethane, and with greater safety. Almost all the few recorded accidents due to trichlorethylene have been found to be due to carelessness in its use, since it can be used with complete safety in a modern standard plant if reasonable precautions are taken in regard to ventilation. A recent Home Office report (see Annual Report of the Chief Inspector of Factories and Workshops for the year 1932, p. 106) has emphasised the high degree of safety which can accompany its use by the observance of very elementary precautions.

A Particular Phase of Solvent Recovery Practice

Purifying the Recovered Solvent by Fractionating Still

SOLVENT recovery plant of various types, depending upon the nature of the material that is to be recovered, is made by the Kestner Evaporator and Engineering Co., Ltd. Broadly speaking, such recovery plants can be divided into two groups, (a) where it is a question of recovering solvent in vapour form from gas or air, and (b) where it is a matter of recovering solvent present in the liquid phase from a mixture of other liquids.

In the first group various types of plant may be used, depending upon the concentration, temperature and nature of the solvent which will determine the most advantageous system. Recovery is effected by means of absorption either in water or some other liquid, or alternatively in a solid absorbent such as silica gel or carbon. For the recovery of the solvent the plant being arranged in such a way that it is operated continuously, and the absorbed solvent is removed from the absorbent by some suitable method of heating. In most cases the recovered solvent from the absorbent contains appreciable quantities of water due to the condensation of the steam which is used to evaporate it. This amount of water may frequently be as much as some 3 or 4 parts of steam to 1 part of solvent. In order to prepare the solvent for further re-use, it must, therefore, be separated from the water. This is effected by gravity separation if the solvent and water are immiscible, but if not, separation is effected by fractional distillation. Continuous fractionating columns are most suitable for this type of work as once they have been set into operation, practically no attention is required.



Part of a Kestner Patent Continuous Fractionating Still.

The Kestner Still

The Kestner patent fractionating stills are generally of the bubble cap type, allowing intimate contact with vapour and liquid, specially designed to reduce entrainment and give high efficiency. Wherever possible thermometers are fitted for registering the temperature on different plates, these thermometers being of the electrical type connected to a central instrument for remote control. By turning the dial on the instrument, the temperature on any part of the column can be read instantaneously, thus giving a visual indication as to the operation throughout the column, and enabling the operator to observe the results of any adjustments that may be made on the operating valves. The steam and water control valves are centralised at one point adjacent to the temperature control so that the whole plant can be operated by one man for the short attention required on starting up and periodical inspection. The accompanying illustration shows a photograph of part of a Kestner patent continuous still, the controls, condensers, etc., not actually appearing in this illustration.

In the second group of solvent recovery plants to which reference has been made, the recovery of solvents from liquids is a somewhat more varied type of problem, as the other materials present may sometimes be in the form of solids in solution, or alternatively, a mixture of such solids with other liquids which are themselves volatile, having similar boiling points to the solvent. In general, any dissolved solid is first separated by evaporating as much as possible of the liquid, and if the pure solvent is not obtained in this way, a subsequent fractional distillation has to be carried out. For the evaporation, the type of plant would depend to some extent upon the percentage of liquid to be removed but the Kestner patent continuous evaporator is often very suitable for this purpose, whereby some 90 per cent. of the liquid is evaporated. The residue can then be rejected or if particularly valuable, further treated for the remaining solvent.

The Kestner Evaporator and Engineering Co., Ltd., also make electrically-operated stills for solvent recovery purposes, such stills being arranged with fully automatic control.

The Cellulose Lacquer Trade

An Extensive Field for the Use of Solvents

IN spite of the many new solvents recommended and introduced to the cellulose lacquer trade, the very striking fact stands out that they have not been able to maintain a place in commercial usage against many of the old and well-tried favourites, *viz.*, amyl acetate, butyl acetate, ethyl acetate, and butyl alcohol. Undoubtedly other solvents are used with these particular favourites in special cases and under special circumstances, but there appears to be no likelihood of any solvent offered in the near future at a competitive price which will have properties sufficiently attractive to relegate to the museum any one of the four mentioned above.

During war time the use of "cellulose dopes" was almost entirely confined to the application to aeroplane fabrics, but to-day the use is much more widespread.

The firm of A. Boake, Roberts and Co., Ltd., was founded in 1870 by the late Mr. Arthur Boake, who in that year commenced the manufacture, at Stratford near London, of chemicals used as preservatives. In 1875 he was joined by the late Mr. F. G. Adair Roberts, and in 1897 the business was incorporated as a limited liability company. Early in this century the company recognised the possibilities of nitrocellulose for industrial use, and was amongst the first manufacturers of solvents required for this purpose. To-day extensive use is made of nitro-cellulose and acetyl cellulose for all classes of work, and the development of the industry has created a demand for other chemicals such as plasticising agents, synthetic gums, etc., which the company is producing on a very large scale.

During the present year the old British engineering standards for most of the cellulose lacquer solvents have been replaced by those of the British Standards Institution.

Insulin Free of Duty

THE Chancellor of the Exchequer has done well to abolish the import duty on insulin. The duty was recently imposed, following an official decision that insulin is a chemical and not a drug. But it was at once pointed out by diabetics—notably by a correspondent in "The Independent," of April 14 last—that an insulin duty meant a tax on their disease. For the sufferer from diabetes insulin taken regularly means a healthy life: deprived of insulin the patient suffers and dies in a few hours. Thus the insulin duty was calculated, for all but wealthy people, to increase the mortality from diabetes. Mr. Chamberlain has wisely dropped so pernicious a tax.—"The Independent," May 19.

Solvents and Plasticisers for All Purposes

Properties and Quantities which Determine Choice

THE increased consumption of Sextone and Sextone B by the cellulose lacquer trade during the past year indicates, in general, a widening appreciation of the excellent qualities of these well known solvents. Sextone (cyclohexanone) is a colourless liquid with a boiling range of 154°-156° C., and a flash point well above the usual lacquer solvents, *i.e.*, 117° F. It is used as a "medium boiler." It is a good solvent for cellulose acetate and has unsurpassed solvent action on the cellulose ethers. It is also a very powerful solvent for a large number of resins and gums, particularly for ester gum, colophony, elemi, kauri, manila, orange and bleached shellac, bakelite, the albertol range, glyptals, rezyls, vinyls, coumarone, indene, and cyclohexanone resin. A.W.2, as well as for wax-free bleached shellac.

Some Applications of Sextone

Sextone is used both in spraying and in brushing lacquers, giving good flow and producing clear, smooth, glossy, tough and strongly adhesive films. It gives excellent blush resistance and, in lacquers containing it, it is unnecessary to incorporate butyl alcohol or a high boiling ester for this purpose. Its dilution ratio is 7.25 with respect to toluene and xylene and 6.5 for benzene, which are higher practical dilution ratios than those of any other lacquer solvent. The combination of the high solvent power for nitrocellulose and high dilution ratio means that a considerably higher percentage of nitrocellulose can be kept in a lacquer than when weaker solvents such as butyl acetate are used, which it can, with every advantage, replace.

Sextone is also a particularly effective solvent for blending nitrocellulose and resins in lacquers and does not need the assistance of a special resin solvent. Sextone and Sextone B are the only solvents which will blend nitrocellulose and Indene or Coumarone resins in lacquers; because of their unique blending properties they are used successfully in nitrocellulose linseed and tung oil combinations, or in dopes for application to leather where their blending powers help to give greater adhesion and "key." In general, it may be said that Sextone and Sextone B overcome the most difficult cases of incompatibility between resins and nitrocellulose. This extremely powerful solvent action is of particular use in synthetic resins lacquers, and paint removers, and both solvents readily dissolve crude rubber. It is also of interest to emphasise the non-toxicity and very high flash points of both these solvents.

Sextone B, which possesses most of the characteristics of Sextone has a boiling range of 160°-170° C. and a flash point of 130° F. It has a slightly higher evaporation rate than Sextone but it not quite such a good solvent for cellulose acetate. Both, however, are very good solvents for basic dyes, and are used for wood staining, where their penetrating and non-grain-raising properties are of great use.

Sextol

Methylcyclohexanol (Sextol) is a colourless, viscous liquid with a boiling range 160°—180° C., and a flash point of 155° F. Its physical and chemical properties closely resemble those of Cyclohexonal which has a boiling range of 160° C. and a flash point of 155° F. Both Sextone and Cyclohexanol are excellent solvents for fats, oils (fixed, mineral, and essential) waxes, and for several classes of dyes, particularly for basic dyes and for certain acetate silk dyes of the Duranol class. Similarly they are very good solvents for a large number of resins and gums, and are used in synthetic resin lacquers of the stoving type, owing to their high solvent powers for synthetic resins and suitable evaporation rates.

In nitrocellulose lacquers Sextol and Cyclohexanol are used as high-boiling alcohols, retarding evaporation and preventing blushing for which purpose they are most effective, but care should be taken that they are not used when only low-boiling solvents are present. They are used chiefly in brush lacquers, and give good flow to lacquers of this type. Although not active the act as "latent" solvents for nitrocellulose, as 50 per cent. dilution with any other cotton solvent will give dilution ratios not much lower than that of the active solvent itself.

For incorporation in soaps and preparations of the sulphonated oil, hydrocarbon and fatty alcohol types Sextol and cyclohexanol are particularly suitable, owing to their remarkable solvent, wetting-out, and emulsion stabilising powers. Soaps containing Sextol or Cyclohexanol have much greater detergent powers and higher solubilities than those not containing these solvents. And they are frequently incorporated in textile, laundry, dry-cleaning and household soaps. The carbolic coefficient of Sextol by the Rideal Walker method is 1.5, and soaps in which it is incorporated possess marked insecticidal and germicidal properties without being toxic.

Sextol and Cyclohexanol are also of great use in the preparation of water-soluble solvent, dispersing and emulsifying agents for oils, fats, waxes, hydrocarbons and dyes. They have very high stabilising powers for emulsions; Sextol soaps, in particular have remarkable solvent and emulsifying powers for fats, fatty oils, mineral oils, waxes, hydrocarbons and hydrogenated and chlorinated hydrocarbons. The greatest scope for these valuable properties is in the textile trades, but they also have very useful applications in the manufacture of oil-bound water-paints, polishes, emulsions of bitumen, pitch, etc., and disinfectant and insecticide emulsions.

An Anti-Skinning Agent

Sextol, considered alone, is widely used as an anti-skinning agent and a small percentage incorporated in the varnish, paint or printing ink usually remedies the trouble. It is also used in printing and marking inks of the spirit type owing to its high solvent power for shellac as well as for basic dyes. In the textile trades it is largely used in the scouring, desizing, dyeing and printing of textiles, and in the delustring of acetate silk.

Ethyl lactate is a colourless liquid with a boiling range of 145°—160° (95 per cent.) and a flash point of 125° F. As a result of constant improvement in manufacture this solvent, which is practically neutral, is only hydrolysed by water (hot or cold) with the greatest difficulty, and then not to any appreciable extent. It is non-inflammable, non-explosive, and non-toxic. It is an excellent solvent for nitrocellulose, cellulose acetate and ethers, and a good solvent for many resins, and gums, particularly for colophony, manila, kauri, Albertols 35 K, 72 W/33, 75 Z/33, and Albertol shellac, glyptals, vinyls, orange and bleached shellac.

In nitrocellulose lacquers ethyl lactate is used as a solvent of the "medium boiler" type; it is used both in brushing and in spraying lacquers. The rate of evaporation of this solvent produces lacquers having exceptionally good flow and brushing properties and giving smooth, highly glossy coats; it is one of the most efficient solvents for preventing blushing, and has a dilution ratio of 6.25 with respect to toluene and 5.75 to xylene. Ethyl lactate is very stable, even in the presence of alkaline pigments, etc., and of resins and oils of high acid content, provided that water is not present to any appreciable extent. Lacquers containing this solvent and alkaline pigments have been stored in tins for more than 8 months without deterioration or hydrolysis taking place.

Solvents for Cellulose Acetate

The range of solvents for cellulose acetate is not large. The majority suffer from the drawbacks of being very inflammable or toxic or, in some cases, both, and they are nearly all of the "low boiler" type. Hence "medium boilers" like ethyl lactate and Sextone, and a "high boiler" like diacetone alcohol, are in great demand. The dilution ratios of ethyl lactate with cellulose acetate are from 3 to 12 times those of any other solvent. As a good solvent of cellulose acetate, and because of its suitable evaporation rate, ethyl lactate is used in acetate injection moulding; in French

polishes it is very effective for preventing "chilling." In the textile trade ethyl lactate is used in printing with basic colours, as a solvent for the dye, for relustring acetate silk, and for "spotting" stains in pieces (acetate silk excepted).

Diacetone alcohol is a colourless liquid with a boiling range of 160° to 170° and a flash point of over 113° F. It is now of greater stability and higher flash point as a direct outcome of improved manufacture. It is non-toxic, is a very good solvent for nitrocellulose, and fairly good for cellulose acetate. Its evaporation rate is considerably lower than that of ethyl lactate. In lacquers it is used as a high boiler. It is a very good solvent for many resins and gums, and is a very good solvent for orange, bleached, and wax free bleached shellac. It is incorporated largely in brushing lacquers where its suitable evaporation rate produces films of good flow and high gloss. Both ethyl lactate and diacetone alcohol are non-solvents of crude rubber.

Acetal solvent is a colourless liquid boiling between 75° and 85° C. It is used in lacquers as a "low boiler" having an evaporation rate between those of ethyl and butyl acetates. It is a powerful solvent and blending agent for all types of resins and nitrocellulose. Extremely high ratios of kauri and manila copals can be used with nitrocellulose to form tough, hard, high gloss, wood lacquers. With an alcohol soluble cotton, this acetal solvent is useful in overcoming resin incompatabilities which occur when using other low boiling solvents and ester soluble cottons.

Plasticisers derived from the cyclic series of solvents, possess to the same degree the many excellent qualities of the latter. Chiefly among these may be mentioned Barkite (methylcyclohexanol oxalate) and Barkite B (dimethylcyclohexanol oxalate). Barkite boils at 190° to 200° C. at 10 mm., is insoluble in water and distils without decomposition in vacuo. It is used as a plasticiser in nitrocellulose lacquers. It is a good solvent for nitrocellulose and has a higher dilution ratio with respect to toluene than any other plasticiser now on the market, with the single exception of Barkite B; its dilution ratios for toluene, xylene and white spirit are far higher than those of tricresyl phosphate. Barkite is a good solvent for many resins, both natural and synthetic, It imparts great flexibility and adhesion and a particularly fine gloss to lacquer films, does not cause tackiness when a fairly high proportion is used, and its plasticising effect is permanent. One of the most useful properties of Barkite as a plasticiser is that it actually decolourises on exposure to light, whereas most plasticisers discolour, some of them considerably.

Barkite is compatible with any proportion of castor oil, or any of the drying oils or their polymers, in a lacquer. It is an excellent oil and gum solvent and may be used with advantage in small percentages to plasticise short-oil and quick-drying varnishes. When wrinkling trouble occurs with tung oil varnish films, this can often be prevented by the addition of a small percentage of Barkite, which also ensures perfect solution being obtained.

Barkite B is very similar in appearance to Barkite, slightly more viscous, practically colourless and odourless. It boils at 180° to 200° C./4 mm. and its vapour pressure is much lower than that of Barkite. It is used as a plasticiser in nitrocellulose lacquers and for nitrocellulose film. It is an even better solvent for nitrocellulose than is Barkite and its dilution ratios for toluene, xylene, benzol and white spirit are 50 per cent. higher than almost any other plasticiser. All other remarks under Barkite apply equally to Barkite B. Both of these plasticisers give a remarkably high gloss to lacquer films, and because of their light-resisting qualities are used extensively in white lacquers. Both these products are excellent anti-skinning agents.

Sextol Phthalate, which has only very recently appeared on the market, is a viscous liquid which is non-volatile. In nitrocellulose lacquers it is used as a plasticiser, and with the incorporation of Sextone B, coumar can be successfully blended with cotton without any risk of bloom on drying. Sextol phthalate is also an excellent plasticiser for orange shellac.

A recent publication "Solvents and Plasticisers," giving fuller particulars of the foregoing solvents, may be obtained free of charge on application to Howards and Sons, Ltd.

Acetamide, a Notable New Solvent

By S. J. COHEN, President, American Chemical Products Co.

A SOLVENT, which is now manufactured in the United States in industrial quantities, which, although very closely analogous to water in its solvent powers, nevertheless combines with acids to form salts similar to aniline salt, while it is itself neutral, plainly possesses all sorts of chemical and commercial possibilities.

Acetamide, the amide of acetic acid, possesses quite unique chemical characteristics. It contains a methyl group; a carbonyl group, allied to the ketones, esters, and acids; an hydroxyl group, allied to the alcohols and water; an amino group, allied to ammonia. Obviously its chemical possibilities, especially in organic synthesis, are exceptional, and it has in fact long been used in the preparation of methylamide and a number of complex organic medicinals. Of particular interest is the quality of acetamide which permits it to combine with acids, and yet it partakes in fact of both acid and basic characteristics, while itself neutral in reaction. Professor Stafford has pointed out very clearly its analogy to water in the close correspondence shown by the solubilities of inorganic compounds in the two and also by the chemical behaviour of the dissolved substances; by the close resemblance of the conductivity curves of salts in the two solvents; by the electrodeposition of metals in acetamide solutions, and finally by indications that acetamide seems to function like water of crystallisation. Naturally there are numerous patents covering different applications of acetamide. There are two German patents for its use in ammonium nitrate explosives; the Winthrop Chemical Co. has a patent for its use in tablets to make rather insoluble medicinal agents instantly soluble; another patent covers its use as a solvent in the manufacture of "safety glass" using it as a bond for gelatin and cellulose acetate. In combination with formaldehyde it has long been known as a powerful antiseptic agent, tradenamed "Formicin." It has also been employed in soldering flux combinations, and Worden has indicated that it is useful as a plasticiser for cellulose acetate, which I have empirically confirmed in the laboratory.

Since acetamide is soluble in its own weight of water and possesses definite hygroscopic powers, it will prove to be a very good moistening agent, keeping glue, gelatine, leather, cloth, and various films and coatings soft and pliant. It can be made up in an efficient anti-freeze solution and it may be useful in cosmetic creams and lotions. Perhaps it might work very well in this connection to absorb excess alkali. On the other hand, it might be very useful as an antacid in lacquers and in explosives. It would appear to be possibly useful as a buffer agent in salt solutions. Kauffmann ("Amer. Dye. Rptr.," *21*, 644) clearly indicated its possibilities as an activator in textile bleaching, and it may certainly be expected to work as a water soluble penetrating agent.

The above suggestions give some indication of the wide variety of uses which may be expected to develop for this interesting chemical. They do not cover the field for, as an example of the unexpected uses, we know that acetamide has already been used as a special food for growing yeasts.—"Chemical Industries," February, 1934.

A NEW company, known as Power Alcohol (Rhodesia), Ltd., has been registered in Salisbury to manufacture dehydrated power alcohol from maize and other vegetable products for admixture with petrol. This factory is to be erected in Salisbury, and at the beginning it is to use 40,000 bags of maize a year. One member of the board is a Government nominee.

The Acticarbone Process of Solvent Recovery

Some Typical Installations

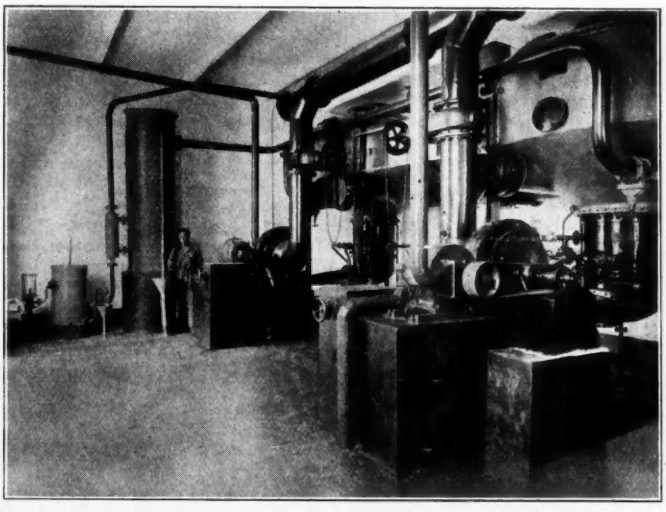
CONSIDERABLE developments have taken place during the year in the uses and application of the acticarbone process of solvent recovery, not only in this country, but also throughout Europe.

The greatest interest has naturally developed in connection with those processes using the more expensive organic solvents, either alone or in mixture, such as acetone, ethyl acetate, alcohol, trichlorethylene, etc. With these solvents, the highest efficiencies in recovery practice, combined with careful and efficient rectification, are necessary for real economy. Four large new plants for the recovery and rectification of such solvent mixtures are actually in construction in this country at the present time, and many more abroad. This is in addition to plants for recovery of solvents such as benzine, naphtha, etc.

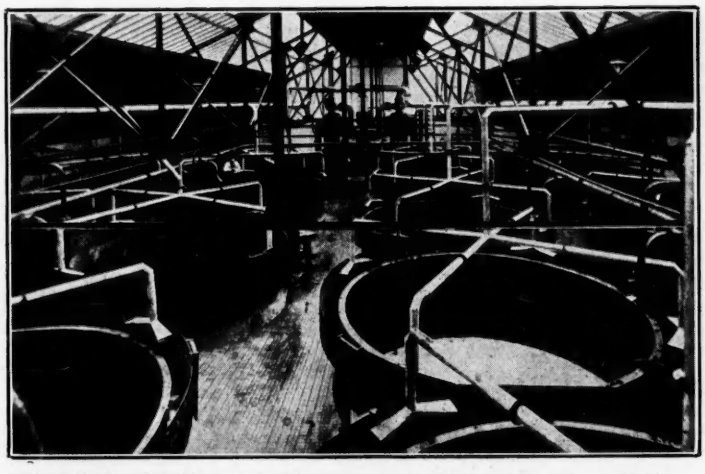
About 230 acticarbone plants are now in operation, and many more in construction. This is a striking proof of the efficiency and technical perfection of the process in recovering all classes of solvents from the vapour form. An interesting and recent development is in the recovery of alcohol from the gases given off in the fermentation process for the production of spirits, industrial alcohol, etc.; many French distilleries are now so equipped.

The accompanying four photographs reproduced by courtesy of Price, Stutfield and Co., Ltd., show typical acticarbone installations.

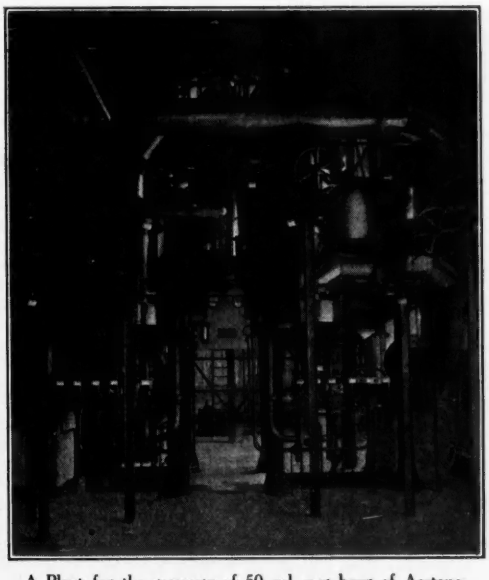
A Large Plant recovering Xylene at an extremely low concentration of vapour in the air. The simple control of the whole plant from floor level is clearly shown.



A Typical Acticarbone Plant for the recovery of Rubber Solvent, showing the aspiration fans to extract the vapours from the process room, absorbers, condenser, etc. Clean dry solvent fit for re-use is delivered through the water.



The Collection of the Fermentation Gases from a series of open vats in a French Distillery. The gases so collected are aspirated by the Acticarbone Plant, the entrained Alcohol is recovered and the carbon dioxide is purified.



A Plant for the recovery of 50 gal. per hour of Acetone, Alcohol and other solvents. It delivers these separated and rectified for use in the process again—viz., the manufacture of "Leather Cloth."

The Silica Gel Solvent Recovery Process

An Outline of its Advantages

SOLVENTS such as alcohol, ether, ethyl acetate, benzole and acetone, are used in the manufacture of rubber goods, artificial silk, leather, etc., and are eliminated from the final product by evaporation during the process. They are expensive and must, so far as possible, be recovered, or the cost of the finished products would be excessive. As a result of the intense competition in this field, the most efficient recovery process is demanded.

The evaporation of the solvents is accomplished by circulating air, with the result that the solvents are present in the air stream at a low concentration. High concentrations are to be avoided because of the explosion hazard. The two methods of recovery in most general use are the absorption and the adsorption methods. In the absorption method, the solvents are absorbed in various liquids, usually hydrocarbons of much higher boiling points than the solvent or solvents to be recovered. The adsorption method employs either active charcoal or silica gel. The advantages of using the silica gel adsorption method is immediately evident when it is noted that: (1) the adsorbent is absolutely inert, whereas other substances in use are inflammable; (2) its mechanical strength is great; and (3) it can be heated to high temperatures in the presence of air for complete reactivation without deterioration.

The usual type of silica gel installation, as supplied by Silica Gel, Ltd., for general solvent recovery consists of two adsorbers and auxiliary equipment. The solvent laden air is first cooled in a pre-cooler and thence is conducted to one of the adsorbers. In this adsorber, the solvent-air mixture is stripped of the solvent, together with any moisture that may be present. This removal of moisture as well as the extraction of solvents is an important factor, since many of the materials requiring solvents in their manufacture are highly sensitive to variations in the moisture content of the air. It is, therefore, a distinct advantage to utilise the air treated by silica gel to condition the area in which the process takes place.

While one adsorber is recovering solvent from the solvent-air mixture, the other adsorber, now saturated with solvent and mixture, is regenerated. The adsorbed solvents are displaced from the gel pores by passing steam at atmospheric pressure through the adsorber. The steam and released solvents are then conducted to a condenser where they are converted from vapours to liquids. If the solvent is miscible in water, the mixture is delivered to a rectifying column and the solvent is there separated. If the solvent is not miscible in water, it is decanted and recovered in an uncontaminated condition.

After the solvent is released, any residual steam is driven off by passing heated air or products of combustion through the gel beds. At the completion of this operation, the adsorber is again ready to be introduced into the adsorption cycle. In cases where high boiling hydrocarbons are present in the solvent, the silica gel is occasionally given high temperature treatment, which thoroughly cleans it, thus restoring it to its original efficiency.

Colour Measurement and Standardisation

Investigations at the National Physical Laboratory

THE annual report of the National Physical Laboratory, which we reviewed at some length last week (THE CHEMICAL AGE, May 19, pp. 427-428), records that further progress has been made with the redetermination of the properties of the standard light sources established by the Commission Internationale de l'Eclairage. The new type of containing cell for the filters used with these sources, which was mentioned in the last report, has continued to prove satisfactory. An improved technique for preparing the solutions from recrystallised salts has been developed during the year, and this, together with the use of the new cells, has enabled the standard filters to be prepared to specification with considerably higher accuracy than was formerly attainable. The three dyed gelatine filters hitherto used as standards for the determination of the luminosity factors of the scales of colorimeters submitted for test, have been replaced by coloured glasses. This only proved possible after a considerable number of glasses had been examined for colour and transmission. The set now obtained meets the technical requirements for this work, and has the important advantage over the original standards of being more stable, and so requiring less frequent checking.

Standard Schedule for Colours

Copies of the British Standard Schedule of Colours for Ready-Mixed Paints, which were sent two years ago to stations abroad having varied climatic conditions, have been returned for inspection during the year. Some of the colours, when compared with the original standards kept at the Laboratory, showed more or less marked changes. Measurements were carried out on the corresponding original standards, to check their permanence when stored in the dark. Most of these showed definite, but very slight, changes, of a kind which could be accounted for by slight yellowing of the celluloid base to which the paint is applied.

There is, at present, a distinct need, for commercial and industrial purposes, of an accurate instrument for measuring colour in which the eye of a human observer is replaced by physical instruments. Preliminary experiments have been made to determine whether a satisfactory instrument of this type can be constructed with any of the known types of photo-electric detectors.

To meet the requirements of the refrigerating industry an apparatus has been constructed to carry out low-temperature measurements of the thermal conductivity of various insulating materials. Corrosion problems in refrigerating plants have also received attention. Instances of corrosion in methyl chloride refrigerating plants are not uncommon, and in one instance it has been found that the corrosion is due, in all probability, to traces of calcium chloride being carried round by the refrigerant from the drying tube which is inserted in the methyl chloride pipe line when the plant is first installed. It has been recommended that silica gel should be used as a drier in place of calcium chloride. In connection with the general problem of corrosion by the calcium chloride brine used as a cooling medium in refrigeration, a survey of the literature has been prepared and is being made available to the industry.

Papers read or published by the staff of the National Physical Laboratory during April included:—

"Estimation of small quantities of fluorides in water," by G. Barr, D.Sc., and A. L. Thorogood, B.Sc. Read before the Society of Public Analysts, April 4.

"The preparation of pure anhydrous sodium carbonate," by W. H. Withey. Read before the Society of Glass Technology, Sheffield, April 17.

"Heat transfer between metal pipes and a stream of air," by E. Griffiths, D.Sc., F.Inst.P., F.R.S., and J. H. Awbery, B.Sc., F.Inst.P. Published in the "Proceeding of the Institution of Mechanical Engineers," *125*, 319.

"Note on the determination of sulphur in alloy steels," by T. F. Rooney. Published in "The Analyst," *59*, 278.

Letters to the Editor

The Editor welcomes expressions of opinion and fact from responsible persons for publication in these columns Signed letters are, of course, preferred, but where a desire for anonymity is indicated this will invariably be respected. From time to time letters containing useful ideas and suggestions have been received, signed with a nom-de-plume and giving no information as to their origin. Correspondence cannot be published in THE CHEMICAL AGE unless its authorship is revealed to the Editor.

Poor King Coal

SIR,—Probably you will regard Sir Samuel Instone's letter as a "private fight," but the subject of coal utilisation is so important that perhaps "anyone may join in." May I say that I was present at the meeting referred to and I heartily agree with every word of your comments. If this is a fair sample of the work of the Coal Utilisation Council, then the many who have, since the beginning, had grave misgivings will be fully justified in their doubts. To put such elementary stuff before the Royal Society of Arts, before an audience which included some of the most eminent fuel technologists in the country, indicates a total lack of appreciation of the situation. Sir Samuel Instone's letter is a confession of weakness if ever there was one. "Please, teacher," he pleads tearfully, "we're doing our best, don't hit us."

The whole tendency of every industry to-day is to set up research organisations, selling organisations and development bodies which shall guide the industry with real knowledge and upon the basis of sound research. Will Sir Samuel please tell us what experience any of the staff of the Coal Utilisation Council has had in the direction of so huge a concern as the selling organisation of the coal industry—or of the coal industry at all for that matter—or what qualifications they have that render them fitted to undertake the direction of a great industrial research organisation which it is surely essential for the coal industry to set up. Too long has the coal industry waited for others to do its development work—the development of hydrogenation by the Fuel Research Board and Imperial Chemical Industries, Ltd., is an instance. So far as the public is aware, and in despite of all the grandiloquent speeches made there is no move to set up any semblance of a research organisation as the word is understood in the chemical industry. The coal industry may not be to blame—it is not impossible that the coal merchants are to blame. As an outsider it has always seemed to me that whilst the coal industry, merchants and owners alike, contains many men of wide experience and as alert as any in the country—men who could put the industry on its feet—the industry carries far too many passengers, far too many whose only object is to apply the brake as hard as may be possible. Nothing has been done yet by the Coal Utilisation Council to dispel the feeling that the "brakers" have the upper hand and that the bold policy which shall put the coal industry on its feet is yet to seek. The letter you publish from Sir Samuel Instone does nothing but makes weak excuses, but if time proves the critics to be wrong, no one will be quicker to say so than the many well-wishers of the coal trade in the chemical industry.—Yours faithfully,

A CHEMIST.

SIR,—I liked your editorial on Mr. W. R. Gordon's paper dealing with the Coal Utilisation Council. These people leave me gasping.—Yours faithfully,

F. C. S.

SIR,—I congratulate you on the note on coal. The first paragraph is absolutely right, and was the expression I used (almost word for word) when I reached home that night, having wasted my evening.—Yours faithfully,

FELLOW OF THE INSTITUTE OF FUEL.

Society of Chemical Industry

Programme for the Annual Meeting at Cardiff

THE South Wales Section will entertain the Society of Chemical Industry on the occasion of its fifty-third annual meeting, which is to be held at Cardiff under the patronage of the King, from Monday, July 16, to Friday, July 20. The full programme has been issued this week by Mr. E. A. Rudge, who is acting as hon. secretary of the meeting. The headquarters of the Society for the week will be at the Technical College, Cardiff, and the proceedings will open with an informal reception at the University College at 8 p.m. on July 16.

Following a meeting of the Council at 10 a.m., the annual general meeting will be held at the Technical College at 10.45 on the morning of July 17, on which occasion Dr. J. T. Dunn (Newcastle) will deliver his presidential address, with Mr. W. A. S. Calder, Dr. William Cullen, Dr. J. T. Dunn and Professor F. M. G. Johnson as nominees for the four vacancies among the vice-presidents. For four vacancies on the council there are six nominations: Dr. W. M. Cumming, Mr. H. W. James, Dr. Herbert Levenstein, Mr. H. W. Rowell and Mr. H. Talbot. Simultaneously with the annual meeting the ladies of the party will participate in an excursion to St. Fagan's Castle, inspecting the grounds by permission of the Earl of Plymouth, and at the close of the meeting the chairman and committee of the South Wales Section will entertain the members and guests to luncheon at the banqueting hall at St. Fagan's Castle. On the Tuesday afternoon there will be a selection of visits as follows: (a) Aberthaw Chemical Works; (b) Thomas Owen & Co., Ely Paper Mills, Cardiff; (c) Spillers Flour Mills (1934), Cardiff Docks; (d) Melingriffith Tin-Plate Mills, Cardiff. In each case the visitors will be entertained to tea by the directors of the companies concerned. In the evening there will be a civic reception in the City Hall, by invitation of the Lord Mayor and Lady Mayoress on behalf of the City Council.

A whole day visit will be paid to Swansea on July 18. En route the members will have the option of visiting the Llandarcy Oil Refineries of the Anglo-Persian Oil Co., Ltd., and seeing the complete refining of crude petroleum to motor spirit and other products, or the Mond Nickel Works, Clydach, where they will inspect the extraction of nickel by the carbonyl process. They will be entertained to luncheon by invitation of the Mayor and Mayoress of Swansea.

On Thursday morning, July 19, the Plastics Group will hold a meeting in the lecture theatre of the department of chemistry at the University College, when Professor H. Freundlich will give an address on "Plasticity, the Servant of Industry." The ladies will take an excursion to Llandaff Cathedral and there will be a Plastics Group luncheon at the Connaught Rooms, Queen Street, Cardiff. In the afternoon, at the Sir William Reardon Smith Lecture Theatre, National Museum of Wales, the Messel Memorial Medal will be presented to Sir Harry McGowan, who will deliver the Messel Memorial Lecture. The annual dinner of the Society will be held at the City Hall at 7.30 p.m.

The Road and Building Material Group will have a meeting at the Technical College on the morning of Friday, July 20, with an address by Colonel C. H. Bressey, chief technical officer of the Ministry of Transport. The ladies will attend a conducted tour of the civic buildings and/or Cardiff Castle.

The programme will conclude with an informal dance at 8 p.m. by invitation of the Chemical Society of the Cardiff Technical College, in the College Assembly Hall.

New Technical Books

CALCULATIONS OF QUALITATIVE ANALYSIS. By Carl J. Engelder. pp. 174. Chapman and Hall, Ltd. 12s. 6d. net.

The subject matter of this book is divided into nine chapters covering the most important types of calculations encountered in the study of qualitative analysis. To recite then in order of sequence these chapters deal with mathematical operations, the writing of chemical equations, the preparation and use of equilibria, solubility product equilibria, complexion equilibria, reagents, molar and gram-ion concentrations, ionization hydrolysis equilibria and oxidation-reduction equilibria.

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DON'T BE AFRAID OF POISON GAS. By F. N. Pickett, M.I.Mech.E., A.M.I.E.E. Pp. 42. Chemical Warfare Defence League. 1s.

This useful little book of hints for civilians in the event of an attack is written in simple language for the instruction of the innocent non-combatant in an elementary knowledge of the art of self-defence against one of the outstanding developments of chemical warefare—poison gas. There is much more apprehension than in our opinion is necessary concerning "the next war" and that is the only criticism we have to make of Mr. Pickett's excellent motive in broadcasting these notes, which are the result of practical experience gained in destroying the greatest accumulation of poison gas the world has ever known. Mr. Pickett has no politics, but "as it is the innocent bystander who usually gets killed, he feels that innocent bystanders should know how to protect themselves." He contends, in short, that fear and panic are the essential dangers in poison gas warfare, and that if these can be overcome such attacks will lose their effectiveness. He suggests the possibility that readers of his book may like to express their views on this important matter and announces that arrangements will shortly be made for them to do so. A nucleus organisation is being formed on a voluntary basis to test the feeling of the civilians of this country on the subject.

* * *

INTERNATIONAL COAL CARBONISATION. By J. Roberts and Dr. Adolf Jenkner. pp. 543. Sir Isaac Pitman and Sons. 35s.

The publication of a scientific work on coal carbonisation which is at the same time essentially designed so that the practical man may appreciate and utilise the researches of investigators is an event of importance. All branches of carbonisation in their earlier stages have suffered from lack of scientific and technical data. It has taken many hundreds of years for by-product coking to reach its present pitch of excellence; it has taken over 100 years for the gas industry to do the same; it is surprising that it has not taken longer since it is only within the last 10 or 15 years that we have really begun to understand the phenomena and the intricate physico-chemical reactions which occur during the plastic stage in coal carbonisation. All these matters are treated faithfully in the book now under review. The excellent photographs showing little known and little understood structures in coke are a standing incentive to the research chemist. A valuable chapter describes the apparatus and methods of the modern research worker upon coal carbonisation, and this description of apparatus is further continued in the chapter dealing with methods for improving the quality of coke. One feels that the first two hundred pages of this book will be invaluable to every research chemist whose work has any bearing on fuel whether his researches are directed to a practical end or not. Adequate but not excessive space is devoted to a description of the modern systems of gas retort and coke oven, and in these chapters the tedium of description is lightened by information concerning the operating results of some of the plant mentioned and the latest ideas on the technique of the art of carbonisation. One of the most important features is the attention paid to the production of solid smokeless fuel. Much of the work and ideas described in the earlier pages concern the blending of coals in order to obtain any desired qualities in the coke. One blend may make an ideal blast furnace coke, another blend may make an equally valuable domestic coke for the open grate. The authors do not exclude the possibilities of making both fuels at equally high temperatures, but it seems more probable that they prefer to carbonise at medium and low temperatures when making the domestic product; 84 pages of this book are, therefore, devoted to low temperature carbonisation systems, and the description of the Coalite Co.'s plant and the results obtained therefrom are particularly interesting since we do not recollect having seen this information in print previously. Chapter XVII which deals specifically with solid smokeless domestic fuel, is primarily concerned with high and medium temperatures and gives the results of experiments conducted by one of the authors at English gasworks. The inclusion of hydrogenation among the by-products of coal carbonisation will make the last chapter of the book of particular interest in view of the Billingham enterprise. The authors evidently feel that the methods of the chemical industry should be applied to coal carbonisation, for they end the book with the words: "The question of the liquefaction of coal has been vigorously attacked by combined interests centred in Imperial Chemical Industries, Ltd., in England, and appreciable strides have been made. Is it too much to hope that a similar combine will be formed to develop the closely allied branch of manufacturing smokeless fuel and coal oils, the latter suitable not only for direct use, but also for hydrogenation?"

New Dyestuffs

Pure Blue of Good Fastness

SOLWAY BLUE PF, a recent addition to the range of fast-to-light Solway dyestuffs produced by Imperial Chemical Industries, Ltd., yields pure blue shades of good fastness to light, perspiration and salt water. It is suitable for dyeing all forms of woollen materials but, on account of its good level-dyeing properties and light fastness, is of particular interest for the dyeing of piece goods. Because of its good fastness to salt water, water and light, Solway Blue PF is of value for the dyeing of yarns for the bathing costume trade, either as a self colour or in combination shades. In addition, it is suitable for all purposes where acid dyestuffs possessing good fastness to perspiration are required. Solway Blue PF is suitable for the dyeing of silk; yielding shades which exhibit the same high standard of light fastness as those produced on wool. It penetrates wool and fur felt readily and is suitable for dyeing hat bodies made of such materials. It possesses excellent affinity for the wool fibre when dyed from a sulphuric acid dyebath. The dyestuff is absorbed at a rapid, but regular, rate as the temperature of the dyebath is raised and maximum exhaustion is obtained after a short period at the boil.

Rich Scarlet Shades

DISPERSOL FAST SCARLET BS, another new production of Imperial Chemical Industries, Ltd., dyes all forms of acetate silk materials and is of interest where dyestuffs possessing good—very good fastness properties come into consideration. It is of good fastness to light, washing and perspiration. As a self colour it yields rich scarlet shades of outstanding brilliance and, on account of its good dyeing properties, it may be used in combination or for shading purposes generally. This product is suitable for the production of print-on styles on acetate silk and yields fast prints which do not mark-off on steaming, whilst ground shades are discharged to an excellent white by the formosul-calcium or zinc sulphocyanide process. Dispersol Fast Scarlet BS may be used in conjunction with other dyestuffs for the production of solid shades on mixed fabrics containing acetate silk by the one-bath method as it is unaffected by acids, alkalies, etc., in the dyebath. It possesses good affinity for the acetate silk fibre. It may be dyed without the addition of assistants to the dyebath; the presence of Lissapol A, soap or soluble oil, however, assists in penetration and level dyeing. Dispersol Fast Scarlet BS is dyed in the manner normal for the duranol and dispersol dyestuffs, at a temperature of 175° to 185° F. (80° to 85° C.) from a bath containing, if desired, a little Turkey Red Oil 50 per cent. or Lissapol A.

Fundamental Scientific Problems in the Food Industry

Dr. L. H. Lampitt's Jubilee Lecture

THE fundamental scientific problems of the food industry are very real problems which may be attributed partly to the gradual change in the mode of life of most civilised nations and partly to the increased demands which the newer knowledge of biochemistry and physiology make on those responsible for the production of food in all its stages. Food science is a comparatively new branch of study. Knowledge gained by chemists in a manner somewhat incidental to their usual work was the basis of the development during the years of the end of the last century, and the definite scientific study of food has grown in a rather haphazard way on the somewhat unsubstantial basis of that knowledge. We have now to build for the future and not only to survey the field but to consider the method of development. The range of subjects involved is more comprehensive than is to be found in any other field of study, concerned as it is with practically the whole gamut of experimental science. It starts with the soil itself; it deals with the plants grown herein, the plant itself, the animal feeding of the plant, the post-mortem changes in the animal, the changes in the plant, the effect of heat, moisture, and cold on the plant and on the carcase, the effect of the prepared carcase, of the prepared plant when digested by man and the physiology of man.

Dr. L. H. Lampitt, chief chemist to J. Lyons and Co., Ltd., was the Society of Chemical Industry's Jubilee Lecturer during the session just ending. He delivered his discourse on some fundamental scientific problems of the food industry before local Sections of the Society in several parts of the country in the course of the session, and his paper has now been published in the Society's Journal.

The fundamental problem introduced by the preservation of food, which has become such an important economic factor in food supplies is the means by which a judgment can be formed of the changes which preservation causes in food. How are the changes brought about in food, by any process to which it may be subjected, to be evaluated? The rough and ready methods of last century no longer hold good—calorific value as a means of assessing the value of a foodstuff present an entirely incomplete picture; in other words, our methods of analysis only serve as an indication of one small part of the value of any food, and it has become necessary to assess much more informatively the effect of changes induced by treatment of whatever nature on those substances which are present in small amounts, and which the work of physiologists empowers us to say may change the course of a metabolic process in a profound way. Therefore, when a food is subjected to some process foreign to those which it has been subjected during untold generations and to which the human body has become attuned, the necessity becomes apparent for basic data which will enable some judgment of the influence of any changes taking place to be formed. Moreover, I suggest that our knowledge of the importance dietetically, of substances occurring in amounts between, say, the vitamins and those revealed by ordinary " gross " analysis is so indefinite, so meagre, that it is impossible for us to form any opinion as to the importance of their presence, and I conclude from this that attention must be given to them by chemists concerned with food.

Remarkably Slow Progress

One of the outstanding examples where fundamental work is essential is in the case of flour. Despite some additions to our knowledge of the fundamental chemical truths about flour, progress in this field has been remarkably slow.

There are perhaps two main reasons for this lack of advance. The first, the complexity of the problem. A grain of wheat as received by the miller is not a standard article—the season, the weather at the time of harvesting, the length of time the grain remains exposed to the weather, period and conditions of storage—all affect the composition of the grain; a little sprouted wheat, not uncommon in Northern Europe, will change the whole protein analysis of the flour made therefrom. Probably the differences caused by normal variations of growing conditions are not of grave importance when gross chemical analysis is carried out, but when it becomes a question of those constituents present in small quantities, when it becomes a question of the relative amounts of various proteins present, when a study of the breakdown products between starch and sugar is in hand, then the difference becomes of great importance, or rather they might be of greater importance, or rather they might be of great importance if any one were able to evaluate them. The second deterrent is the desire to obtain "practical" results, to obtain a single, rapid, practical test to evaluate wheat quality. Of the chemical methods of evaluating flour strength, many can be characterised as gropings in the dark in an attempt to discover that elusive " quality factor " of the wheat. Determinations of surface tension, gold numbers, viscosities, specific rotation etc., of the proteins, as well as the much discussed gliadin-glutenin ratio, have met with no, or at the best very partial, success.

A more complete knowledge of the constituents of wheat would have taught us what we were talking about, and not have left us entirely at the mercy of tests, which are only glorified rule of thumb tests such as the expert baker himself applies. There is too often the desire to refine a factory test and not the keen passion to know " why "; the hit and miss method may be a manner of solving a problem, but what satisfaction can such a method of solution give to the chemist? The trouble is that so many of us who have not the spirit of inquiry in us. Not one of the processes from the milling of flour to the eating of the loaf is understood. Demonstrations of " springiness " in loaves are all very well; but why does one loaf stale more quickly than another? No one knows scientifically because no one understands staling. All these problems are complicated by physico-chemical phenomena as Bungenberg de Jung has pointed out in his study " Colloid Chemistry of Flour Protein " (1930—31), but perhaps even these difficult considerations would become a little less complex did we but know with what chemical constituents we were dealing. If then our knowledge of the main constituents of flour is so meagre, is it to be wondered at that practically nothing of a definite nature is known of the other constituents?

The Study of Meat and Meat Products

The difficulties in the way of anyone wishing to study meat and meat products are equally great. It is impossible to say with any degree of certainty what changes take place during the preparation of meats for consumption. The more visible and easily detected changes have been studied from the time the animal is slaughtered until is is ready for cooking, but as the work of Moran has shown, the changes are little understood, particularly from the chemical standpoint, and changes in the numerous bodies occurring in small amounts have received practically no attention.

The work of Moran and others at the Low Temperature Station at Cambridge has demonstrated the complexity of the problem connected with the ordinary method of preparing carcases for food, and the study of the reactions occurring subsequent to the slaughter of the animal has received considerable attention by these workers. Physical and certain physico-chemical determinations of factors indicating change have occupied them to a large extent, but here again, when judging the effect of the various stages of the process, the difficulty has been to decide upon a datum line. The changes in muscle have been studied in most detail, and the close association between heat production and lactic acid formation has been established. The work of A. V. Hill on the state of the water in muscle and the osmotic behaviour of muscle, and that of Moran on the freezing of gelatin gels have demonstrated the complexity of the physical and colloidal changes which

take place on freezing mammalian tissue, but the number of "unknowns" in the problem is extremely great and it would appear that detailed chemical work of a fundamental nature is here indicated.

The Chemistry of Fruit

During the last twenty years important developments have taken place in our knowledge of the chemistry of fruit, and I think it can be said without fear of contradiction that by far the larger part of this development has been at the spur of commerce. Two considerations have entered most closely into this work, namely, the methods of storing fruit, be it by cold, by inert gases or by other means, and the canning of fruit. The study of the factors influencing these processes has demanded a knowledge of the chemical constituents present in fruit at various stages of ripeness in order to have a basis to which changes could be referred. A third incentive has come from the jam and fruit jelly manufacturers, to whom the mechanics of the pectin-acid-sugar gel are of major importance. Fundamental knowledge, however, of the constituents of fruits has not developed to any great extent. With regard to the acids, for example, the old idea that apples contained malic acid and none other has been to a certain extent substantiated; that lemons contained only citric acid has been proved to be almost correct, but the new work has shown that other acids may be present in small amounts, and the results of Nelson in America have demonstrated the complicated nature of this problem. His results for blackberries published in 1925 show that the non-volatile acids consist of complicated mixtures including large quantities of isocitric acid, smaller quantities of *l*-malic acid with traces of ordinary citric acid, of succinic acid, and of oxalic acid.

Some German Investigators

German workers, Frazen and Halwart, obtained a similarly complicated mixture of acids for apples, including malic acid, citric acid, succinic acid, oxalic acid, and lactic acid, although Nelson, working with American apples, concludes the acid to be almost 100 per cent. malic. These results are of intense interest to the plant biochemist, and a study of the development of these complicated mixtures during ripening is surely one which should appeal to any chemist.

Workers of the Food Investigation Board concerned with fruit have found the necessity for some definite chemical work and during the last few years a study on broad lines has been conducted with particular reference to apples. This has taken the form of periodic analysis of the fruit during ripening and during the period of senescence, showing the accumulation of sugars with the subsequent production of starch and acids during the ripening period. The methods of analysis have been of a straightforward nature and but little differentiation has been attempted.

The methods of analysis available to determine the amounts of the various constituents present in fruit are complicated and not too reliable, as the analyst understands reliability; in fact, Nelson used the vacuum distillation of esters with subsequent freezing point determination of the hydrazines.

Work on the pectin-acid-sugar gel brings in colloid chemistry. The chemistry of pectin has been studied in some detail and the interesting facts regarding the effect of the introduction of methyl groups on the properties of the pectin have demonstrated how much is yet to be learned in organic chemistry. The development of sugar, or rather of sugars, in ripening fruits appears to me to be of great interest, but here the difficulties of analysis are great and for routine work the methods applied by the Food Investigation Board are no doubt sufficiently elaborate.

Orange Drinks

During the last few years, orange drinks have become deservedly popular. The consumer, either advisedly or not, requires these drinks in and out of season at an economic price. Therefore it is desirable to preserve in some way orange juice made when oranges are plentiful for the time when they are scarce, or alternatively to prepare orange juice in a producing country, *e.g.*, Africa, for sale in England. No methods have yet been found whereby the freshness can be retained over a period of storage.

Many investigators have studied the tannin question. As would be expected, the majority have confined their attention to tannin as a tanning agent and not to the tannin bodies found in the common drinks, tea, coffee, and cocoa. The information available regarding tannin and leather is, as would be expected, extremely voluminous. A "trade" depends upon our knowledge of the reaction involved and therefore much money has been spent on the elucidation of the various problems. A trade does not depend upon the solution of the properties of tannin in the beverages mentioned, and therefore little money has been spent on it.

Chemical Problems in Tea

Two purely chemical problems connected with tea are of intense interest. An article appeared in the "Lancet," in 1911, by which the author entered the lists of the "digestive" controversy. He stated that since caffeine and tannin are combined in tea in the proportion of 1 to 3, the undesirable pharmacological and physiological properties of both caffeine and tannin were neutralised. The statements were based on poor chemical evidence. We have done a certain amount of work on the problem and agree that tannic acid and caffeine mutually precipitate each other, but that the composition of the precipitate depends on the relative amounts of the two ingredients mixed together. Moreover, we find that a caffeine-tannin complex can be precipitated by ammonium sulphate from tea infusions—the ratio of 1 part of the former to something less than 2½ parts of the latter. We are not in a position to say how constant this ratio is with different teas. The composition of the complex has to be determined by some method of analysis and as I have already stated, these are not entirely satisfactory for the purpose in view.

It has been stated on little authority that the tannin present in a tea infusion becomes absorbed by or precipitated with the proteins of milk when the two are mixed. This involves the consideration of two unknown complexes, namely, tea-infusion and milk. From work carried out in our laboratory it can be said with a fair degree of certainty that globulin and albumin of the milk are precipitated when mixed with tea-infusion and that the caffeine takes no part in the precipitation as it may be readily removed from the mixture by dialysis.

In the realm of cocoa and chocolate too, knowledge is fragmentary. For example, one of the most important questions to the grower of the cacao bean is that of the development of colour. The published work on cacao-red and cacao-brown is considerable, and some interesting work has lately been recorded by Steinmaan on the production of colour in Java cacao but, as Knapp has shown, the chemistry of the fermentation of cacao beans is but little understood, and as this development of colour is probably profoundly influenced by acid and light the condition under which the fermentation takes place if of great importance. The subject is not only interesting, it is also economically important.

The Chemistry of Milk

There are so many people investigating milk and milk products, but they are so much interested in the production or utilisation of it, that they have little time for the chemistry of the subject. The study of fats in general has received considerable attention during the last few years. In particular, I would refer to the important work of Hilditch, who has lately directed his attention to butter fat, a product which in the past has been very little understood from the fundamental chemistry point of view. The information gained by the work of Hilditch may enable some decision to be made on the vexed question of the development of "tallowy" flavours in butter and milk powders, as distinct from the "rancid" flavours produced by micro-organisms. Much has been written on the effect of ultra-violet light on these products, but the work is of little use for two reasons; firstly, it has not been referred, except vaguely, to the composition of the butter fat, and secondly, no attempt has been made to measure the energy output, or to specify the wavelength of the source of light incident on the fat. This latter problem is a somewhat difficult one but until it is definitely solved it is impossible to compare the results of one worker with those of another.

One of the most outstanding examples of lack of standardisation of a method is before the chemical world now. It

is the method of determining the cystine content of a protein. For year, investigators have been content to follow the method of Sullivan, yet the first time we wished to use it in my laboratory we found it was most unreliable. Latterly Lugg has published a series of papers on it, and a number of other investigators have applied themselves to it. Yet large numbers of experimenters have used this method and it is disturbing to think of the amount of work which has been built on such an unsubstantial basis, but the fact remains that the investigators were content to use a method which they did not test for themselves.

Analysis of Milk Products

A further group of substances which will repay attention is the phospholipoids. Some American workers have just demonstrated how far they affect commercial analysis of milk products. But this group of "fatty acid-phosphoric acid-nitrogen" compounds is complex and its study has been rendered difficult by the small amounts in which the various phospholipoids occur in natural products, and also by the ease with which they are oxidised. Their colloidal properties make them of great importance, and have been the cause of the attempts to sell them, naturally not in a pure state, and to claim for them all kinds of properties which in many cases, as far as my experience goes, cannot be substantiated.

The controversy regarding the pasteurisation of milk has two aspects, the bacteriological one and the chemical one, and those who would have the milk distributed raw have spoken in vague terms about the changes brought about by heating. Excluding the vitamin question, it would appear that an appreciation of the composition of milk might have been of great importance, in that light might then have been thrown on the changes effected by the pasteurisation treatment, and that changes do occur, is of course, well known.

Need for Collaboration

Laboratories in this country can be broadly classed into four groups:—Academic = university; state and publicly supported = research stations; trade and state helped = research associations; private = commercial. One of the most urgent problems is to consider how far these various organisations collaborate, and whether any such collaboration which does exist could be developed and made more effective. Each class has, of course, its own particular function, but evidence of overlapping is not difficult to find. I do not know of any modern survey of the scope of various experimental stations, and such a survey by an independent person would be essential before any scheme for national collaborative work could be drawn up. With the goodwill of the various governing authorities the development of our knowledge should proceed apace and the duplication of work which occurs at the present time obviated. We have the laboratories, we have the workers. Surely some effort could be made to avail ourselves of these great national potentialities.

I am not suggesting that any special control should be exercised over the various establishments but that there should be some definite policy to which all should work in their respective spheres of activity. The lack of contact between the worker and the industrial world leads to great waste of time, for the former often works on problems which he thinks to be of practical importance while a representative of the latter could demonstrate them to be of no appreciable utility.

Privately-Owned Laboratories

With regard to the work of privately owned commercial laboratories, I suggest that there should be a broader distribution of purely scientific data which they collect. The secrecy often imposed on such organisations is a serious drawback to an advance in our knowledge of food chemistry. It is rarely that a firm has chemical knowledge which is of commercial importance to the firm; it is seldom that to disclose the results of a chemical investigation would be to play into the hands of competitors. There is naturally no necessity to explain the reason why this or that investigation started, and it may be that I am too optimistic in my opinion of the knowledge of chemists in food industry, but in all probability a large amount of work is stored in commercial laboratories which without any disadvantage to the owners could be given to the scientific world. In fact, I maintain it would redound to their credit.

The people most nearly concerned with food processes are the chemists in food industries. Very few firms are sufficiently enterprising to allow their chemists to push their investigations past the "practical" stage and even then their results are often locked up so that they cannot be passed on to the academic worker who perforce must be content to carry on with his preparation of endless derivatives. The university is the training ground for the chemists of the future, and we all admit that specialisation before graduation is a mistake. But if the class of one or two-year research students is to continue, I would suggest that experience in applied problems would be of use not only to them, but to industry, which after all must eventually absorb most of them.

Bodies of natural origin are waiting in their legions to be investigated, and it is unfortunate that the academic worker has not, speaking generally, undertaken studies in these particular fields. There are, of course, many exceptions—I speak of such work as that of Hilditch on fats, of Walker on hop resins, of Raistrick on the chemical activities of moulds. All these link together organic chemistry of the "pure" type with problems of a more "applied" nature, and indicate the close connection there is between the academic worker and his commercial colleague. Food chemistry will make rapid strides in the future, but to do so, more attention must be given to the science of the subject from the fundamental standpoint. Let us build on solid foundations.

American Institute of Chemists

Medal Presented to Dr. J. B. Conant

THE medal of the American Institute of Chemists, presented annually for outstanding service to chemistry in the United States, has been awarded this year to Dr. James Bryant Conant, president of Harvard University, in recognition of his many contributions to chemical science. Dr. Conant has done notable work in establishing the chemical structure of many complicated organic compounds, including among others, hæmoglobin of the blood substance, chlorophyll, the green colouring matter found in plant life, and a number of other colouring substances occurring in flowers and feathers.

Dr. Conant has applied a new point of view to study concerning well-known chemical reactions, determining the energy changes involved and the energy levels at which the reactions occur. He has devised new methods of laboratory technique for better understanding of the mechanism of organic chemical reactions, as well as new modes of attack upon molecules for a deeper insight into the impelling forces which cause reactions to occur.

During the war, as a civilian, he developed methods for the preparation in the United States of arsenical drugs, the supply of which from Germany had been interrupted. Later in the war, he became an officer of the chemical warfare service, was in charge of chemical research on mustard gas, and devised a method for the preparation of this substance which supplied the basis for large-scale manufacturing operations. Toward the end of the war, he was in charge of an experimental plant for the manufacture of lewisite. In his later researches Dr. Conant has greatly extended the usefulness of electrometric methods, applying them to new problems. He has established a quantitative measure of the effect of the arrangement of atoms in molecules upon the tendency of those molecules to enter into direct chemical combination. Dr. Conant has written three text-books and many papers on fundamental subjects in organic chemistry.

Dr. Conant was named by the Corporation of Harvard University as the 25th president of the University in May, 1933, when he had just passed his 40th birthday, his election at that time making him one of the youngest Harvard presidents. Born in Dorchester, Mass., he prepared for college at the Roxbury Latin School, entering Harvard College as a freshman in 1910. He graduated in three years with high honours, was a member of Phi Beta Kappa and holder of an honorary John Harvard scholarship. He remained at the University for three additional years of graduate study, obtaining the degree of Doctor of Philosophy in 1916. The next year he received an appointment as instructor in chemistry at Harvard. He is one of the scientific directors of the Rockefeller Institute.

Domestic Water Supplies and Lead Pipes

Investigations at the Chemical Research Laboratory

MANY natural waters have a solvent or erosive action on lead service pipes, with the result that the water, unless submitted to treatment, may become contaminated with lead in such quantity as to give rise to cases of lead poisoning among consumers. There is a lack of information not only as regards the best methods and conditions of treatment of plumbo-solvent waters, but also on the relationship between plumbo-solvent character and composition of the water, and arrangements were accordingly made for an investigation to be carried out at the Chemical Research Laboratory, Teddington, into the conditions affecting the action of water on lead. As the result of the investigation the Department of Scientific and Industrial Research has issued, as Water Pollution Research, Technical Paper No. 4, a report on "The Action of Water on Lead with special reference to the Supply of Drinking Water" (H.M. Stationery Office, 2s. net).

The literature on the subject is surveyed and the report summarises the information collected. In addition to brief descriptions of the work of previous investigators, there are sections dealing with lead poisoning from drinking water in different parts of the world and the protective measures adopted. The report has been prepared by Dr. H. Ingleson under the direction of Professor G. T. Morgan, F.R.S., at Teddington.

Safety Limits in Drinking Water

Lead piping has long been used as a convenient means of conveying drinking water to consumers. With many supplies the quality of the water is not appreciably affected as a result of its contact with the metal. There are instances, however, in which the composition of the water is such that it attacks the piping and becomes contaminated with lead. Efforts have been made to define the maximum quantity of lead which can safely be allowed in drinking water, the factors causing action of the water on lead, and the methods of preventing such action. These three aspects of the problem have been the subject of much investigation, and as a result a considerable amount of information is available. Different and sometimes contradictory conclusions have been drawn from the results of various investigations owing to the difficulties involved in any attempt to assess the effects of the many factors to be considered. Among these factors may be mentioned the different dissolved gaseous and solid constituents of natural waters, the surface condition of the metal and the varied susceptibilities of individuals to lead poisoning.

The fixing of the permissible limit of the lead content of a water is rendered difficult by reason of the lack of information as to quantities of water consumed, its lead content, other sources of lead intake and also the amount of lead excreted. Such information to be useful would necessarily have to be available for a very large number of persons of varied ages and occupations.

Eroded Lead

The values quoted by investigators who have attempted to fix the safety limit are of interest as illustrating the different opinions held rather than as criteria of a non-poisonous water. The subject has been rendered still more difficult by the fact that some authors have considered only dissolved lead whilst others have included both dissolved and eroded lead in the figures which they give. Some workers consider the distinction between suspended lead compounds and dissolved lead to be of no importance from the sanitary point of view. In investigations following outbreaks of lead poisoning, the lead content of water drawn from taps in the neighbourhood only gives information with regard to the water at the time of sampling, and it is by no means certain that the values then found are any sure guide to the conditions obtaining during the period when lead absorption was taking place. The term "erosion" applied to the action of water on lead indicates that the water attacks the metal, producing loosely attached material which falls away from the surface leaving it open to further attack. This eroded material settles from the water as a white deposit. The amount of lead collected in a sample depends on the character of the eroded material, on the slope of the pipe, and on the rate of sampling. In many cases the eroded lead may constitute a greater potential source of danger than that present in true solution.

Alternative Metals

The Copper and Brass Extended Uses Council discusses the relative merits of copper, lead and iron for domestic water services in a booklet recently issued on "The Use of Copper and Brass for Domestic Water Services." The opinions are expressed that copper is less dissolved by water than lead or iron; waters not acid in reaction may be conveyed in copper pipes with complete safety since protective films forms on the metal; acid waters when corrected for acidity may be used with the metal; water which is supposed to be unsafe for use with copper cannot be considered suitable for use in lead pipes and cannot be used with iron without risk of excessive rusting. It has been found that the smoother the surface of copper the less is it acted upon by water. Green staining of wash basins, etc., is generally only temporary; continued staining indicates that the water is acid and requires pre-treatment. According to current medical opinion, copper, unlike lead, is not a cumulative poison. Although no attempt is made to define a safe limit of copper in drinking water the Council consider that for a water which does not take up more than 1.4 p.p.m. in 24 hours' contact copper pipes may be safely used.

Certain authors consider that any trace of lead, however small, indicates a potential danger and should preclude the use of lead pipes with the water. The real difficulty arises when the lead content is between, say, 1.0 and 0.1 parts per million. According to some investigators, 0.3 to 0.5 p.p.m. represents the limit of safety and 0.5 to 1.0 p.p.m. constitutes gross contamination. Others consider that 0.1 p.p.m. should not be exceeded. The views expressed show considerable divergence and it is often stated that any attempt to fix a limit is useless. Nevertheless, an authority whose main available supply is one which acts on the metal must, for practical purposes, decide upon some working limit based on experience. Much of the uncertainty is due to the difficulty of obtaining accurate data of the lead content of water consumed and to personal idiosyncrasy and susceptibility of the consumers.

Plumbism, whether due to occupational conditions or to lead in water, is often difficult to detect, especially in mild cases. During outbreaks of water plumbism it is common to find only one or two members of a household affected. Different symptoms have from time to time been considered as criteria but even the detection of lead cannot of itself be taken as proving that a person is suffering or likely to suffer from lead poisoning. Lead is, in fact, normally found and its presence is undoubtedly associated with the widespread use of lead and its compounds.

Protection against Water Plumbism

When an outbreak of plumbism occurs the authority supplying the water usually recommends the adoption of either or both of the following measures: (1) Displacement of stagnant water in the pipes before using any for drinking purposes; (2) the use of some form of filter to remove lead. These precautions are only of temporary value, until a permanent remedy is found.

In certain cases replacement of lead service pipes by iron or copper is practicable, but in others iron and copper are attacked by the water. Enamelled iron has been suggested as an alternative. Tin pipes with lead sheaths are generally satisfactory substitutes for lead when properly fitted with brass couplings to hold the flanged ends together. Sweated joints should not be used with this type of pipe. Tin washed pipes are considered unsatisfactory by most investigators. The deposition of any artificial coatings by solutions used to

fill the pipes are likely to be unsatisfactory, as preliminary cleaning of the metal walls while the pipe remains in position is practically impossible, and the solvent action of the water may gradually remove such protective coating.

If the lead piping is not replaced it is better to modify the water so as to reduce its action on the metal. The methods of modifying the water at the works usually aim at increasing the carbonate hardness or the silica content and a decreasing acidity by addition of alkali or removal of carbon dioxide. Steps are frequently taken also to prevent the presence of excessive quantities of dissolved oxygen.

Opinion is divided as to the relative merits of raising the *pH* by the addition of definite quantities of lime water, chalk, soda or silicate mechanically and by passing the water through beds of marble or limestone. The mechanical addition of the correct dose, it is argued, requires more skilled supervision than neutralisation by passage through marble or limestone. It is, however, frequently stated that slime deposits readily form on the surfaces of the marble or limestone and thus interfere with proper treatment of the water. Calcined magnesite was formerly used in place of marble in a few instances, but its use was discontinued owing to deposition of slime. Recently the method has been revived as marking an advance upon treatment with marble.

Addition of silica, by passage of the water through siliceous material, such as flint or by addition of silicate of soda, is an old method of treatment. Silicate of soda appears to prevent action on lead, but it is not certain whether this is due to a rise in *pH* or to the added silica.

Effects of Water on Lead

Lead determinations in the water of an area where plumbism is suspected are not generally of much value in attempts to fix the permissible limit of lead content, since the samples are often taken after and not during the period when lead absorption was occurring. In addition, so many factors, apart from the condition of the pipe and the properties of the water, affect the amount of lead withdrawn in a sample of water from a service pipe that comparable values are difficult to obtain. The period of stagnation of the water before sampling, the nature of the lead compound produced, the shape, size and density of the particles if suspended, the rate of sampling, the slope of the pipe and the position of the tap relative to the pipe, all have an important influence on the proportion of the total corrosion product withdrawn with the sample. Pressure and temperature exert an influence by affecting the rate of separation of bubbles of gas on the walls of the pipe.

Experiment has shown that in some cases samples after prolonged stagnation actually contain smaller amounts of lead than when shorter contact is allowed. The length of service pipe has been thought to influence the lead content of samples, but it is not always possible to trace any relation between length of pipes in houses in a given district and the lead in the samples of water. Samples from short pipes have in some cases given greater and in some cases smaller amounts than from long pipes. Some pipes give between three and nine times the amount given by others of the same length. Two consumers with apparently similar supplies might thus be receiving very different amounts of lead in their water.

Uncontrolled Factors

Many laboratory methods have been devised to avoid the difficulties arising from the uncontrolled factors met with in practice. Attempts have been made to obtain a reproducible metal surface by treatment with acid, cleaning with abrasives, polishing, scraping and turning strips in a lathe. Lead has been used in the form of pipe or pipe sections, thick sheet, foil, wire and shot, and in each case certain advantages have been claimed. Comparatively little is known about the effect of different methods of cleaning upon the results subsequently obtained.

With lengths of over one foot of lead the chief difficulty is to clean the bore so that the same type of surface can always be obtained. According to the procedure sometimes adopted when a sample of water is withdrawn air replaces it and aeration of the moist tube takes place; this is liable to influence the next experiment made in the tube. Short lengths capable of being properly cleaned may not enclose a sufficient volume of water to enable the effect of only slight action to be determined. Some workers who have dealt only with a particular water have devised a method of "seasoning" the piping to avoid the difficulty of cleaning. The chief advantage in using lead piping is that it is possible to arrange that the ratio of surface area to volume of water approximates to conditions of normal supply. If, in addition, the pressure of the mains can be applied then uncertainty arising from loss of dissolved gasas can be partially avoided.

Tube Packed with Lead

Two methods in which the water being tested flows through a tube packed with lead have been devised. In one the metal is in the form of a long thin ribbon turned off on a lathe, whilst lead shot is used in the other. It seems probable that the lead shot will be covered by a skin of oxide formed during preparation. Many experimenters have immersed the metal in the form of sheet, foil, pipe or wire in water contained in glass vessels. In some cases free access of air is allowed. In long experiments the possible action of water on the glass has to be considered and also the fact that glass once attacked is not in the same condition to resist further attack. The area of lead surface to volume of liquid needs careful control if the results are to be compared with those obtained in lead pipes.

In many cases the analytical methods used to determine lead in samples of contaminated water have not been such as to prevent interference by iron and other metals or in some cases by suspended or colloidal matter. The only satisfactory methods, unless the quantity to be determined is sufficient to allow of gravimetric analysis, seem to be those in which the metal is isolated as some suitable compound and its solution in distilled water is compared with standard solutions also in distilled water.

Action of Water on Lead

In attempts to ascertain the specific actions of substances contained in natural waters, various substances have been added to distilled water for examination. Much of the disagreement which has arisen is probably due to marked differences in the samples of distilled water employed. According to the best experimental evidence, pure gas-free distilled water has no solvent action on pure lead even after prolonged contact. The behaviour of distilled water containing dissolved oxygen and carbon dioxide towards lead seems to depend on the relative concentrations of these gases. It is generally agreed that calcium bicarbonate can protect lead under certain conditions.

The action of water on lead has been associated with physical and chemical heterogeneity. Allotropic modifications of the metal have been reported but the evidence for their existence is conflicting. The modification reported by Heller is probably the residual metal after removal by nitric acid of the intercrystalline impurities. Practically nothing is known of the effects of metallic impurities on the behaviour of lead in water. The effect of water on a sample of lead is markedly influenced by previous mechanical treatment of the sample. Acid waters obtained from moorland sources have given considerable trouble on account of their plumbosolvent action. Acidity and plumbosolvent power have been associated by some workers as cause and effect but others maintain that they are not necessarily associated. With the exception of carbonic acid, the compositions of the acidic substances in peaty waters are unknown.

The bulk of the report is devoted to a review of the protective measures adopted in a number of provincial towns as well as in Continental areas where outbreaks of plumbism have been experienced, and to a summary of the views expressed by different workers on the part played by different dissolved substances.

RATIONALISATION seems to be the by-word in the South African canning industry, for the leading canning men are eager to establish a national reputation for high quality products, and if all the recommendations of the Food Canners' Council are adopted South African jams and canned fruits will be of higher quality than those of most other countries.

Death of Mr. W. D. Borland

Expert in Sporting Powders and Ammunition

THE death occurred on Whit Sunday, May 20, of Mr. William Dalrymple Borland, F.I.C., F.C.S., of Beacon Lodge, Bean, near Dartford, Kent, who had been connected with the Society of Chemical Industry from the time of its initiation fifty-three years ago and knew many of its founders. Mr. Borland was 71 years of age, and was educated at University College, London, under Williamson and Otto Hehner. He was demonstrator in chemistry at the Royal Veterinary College for a short time before going to Stowmarket to develop smokeless propellants under W. F. Reid. He took up practice as a consulting chemist and in 1896 he joined the board of the "E. C." Powder Co., Ltd., becoming managing director and chairman of the company, which has since been absorbed by Imperial Chemical Industries, Ltd. Latterly Mr. Borland acted as technical expert in sporting powders and ammunition to Imperial Chemical Industries, Ltd.

Mr. Borland was a director of the "Architect and Building News" and a Past Master of the Worshipful Company of Gunmakers. He was an abstractor for the Society of Chemical Industry in July, 1882, and for some years afterwards. In 1906 he read a paper before the Society on the ignition of nitro compound explosives. He invented the Borland percussion cap tester, which is still in use, and published a series of photographs of "Shot in Flight." In 1896 he introduced an improved smokeless sporting powder, E.C. No. 3, which is still being made, and during the war he designed special works for cordite. Latterly, his son, Captain G. D. Borland, has been associated with him at the I.C.I. experimental station.

The funeral will take place to-day (Saturday) at Southfleet Church.

Assessments of China Clay Properties

Appointment of an Expert

A LENGTHY discussion took place at a meeting of the Cornwall County Council on May 15, on a proposal to appoint a china clay expert to assist in the assessment of the china clay properties. The County Valuation Committee reported that the county valuer had issued a questionnaire in respect of 120 of the china clay undertakings in the St. Austell area, but owing to the great disparity existing in regard to the terms of leases and the royalties paid, and in the physical characteristics of each undertaking, it would be necessary to obtain a detailed estimate of the future receipts and working expenses of each undertaking. The county valuer, therefore, asked for a specialist to be engaged to obtain this information, and the committee had resolved that the services of a china clay expert be obtained accordingly at a cost not exceeding £250.

Replying to an amendment of disapproval of the committee's action, Mr. T. Blamey, chairman of the committee, said there were three courses open to them. They could allow assessments to go and no doubt lose thousands of pounds; they could employ outside valuers at high fees; or they could make their county staff adequate to deal with this vastly complicated position in regard to china clay. Mr. Gasson was undertaking the valuation of these properties, and the sum involved was many thousands of pounds. They could either allow the china clay companies to make their own assessments, or go thoroughly into the matter and give the county valuer the support of an expert.

The amendment was rejected without a division, and the committee's action approved.

AT the 8th congress of the South African Sugar Technological Association, held in Durban, Sir Charles Smith stressed the need for a chair of sugar technology at the local University College. The sugar industry needed qualified technical men and a chair of sugar technology seemed to be the best way of procuring them. The suggestion was received with applause by the delegates, who came from all parts of the Union.

The Bedson Club

A Lecture on Gutta Percha, Balata and Caoutchouc

THE 26th Bedson Lecture was delivered by Professor G. G. Henderson, F.R.S., at Armstrong College, Newcastle-upon-Tyne, on May 18, the subject being "Gutta Percha and Balata and Caoutchouc." Oxidation of these substances with hydrogen peroxide, said Professor Henderson, yielded a number of non-crystallising products which polymerise above 50°, and cannot be distilled without decomposition. Calculating these products to a common unit C_{50}, the alcoholic product resulting from the addition of hydroxyl to double bonds were respectively $C_{50}H_{88}O_{24}$, $C_{50}H_{88}O_{20}$, and $C_{50}H_{92}O_{16}$. These formed acetates, with some dehydrations, which were respectively $C_{66}H_{92}O_{28}$, $C_{66}H_{96}O_{24}$ and $C_{58}H_{88}O_{14}$; further oxidation yielded another acetate in each case from which baryta formed an alcohol (saturated to bromine) in each case $C_{50}H_{56}O_{14}(OH)_{12}$, possibly identical from each. Reduction of the two former raw materials gave dihydrides with a great change in properties, whereas the hydrochlorides yielded on suitable treatment, not these same dihydrides, but unsaturated hydrocarbons of quite different type.

The dibromides of balata and gutta percha, continued Professor Henderson, condense readily with phenols in the presence of ferric chloride to give coloured compounds, one of which may find application as an indicator. All three molecules may be regarded as condensation products of isoprene with roughly one-half of the unsaturation of the parent hydrocarbon. Further aggregation takes place by partial valencies, and this is broken down by the action of suitable solvents. It would appears that rubber is more complex than the other two. The minimum complexity of all three is 10 units or a multiple of this, the molecular weights of the oxidation products suggesting the larger values. Some oxidation of methylene groups seems to take place in the later stages and the evolution of the carbon dioxide being relatively delayed in the case of caoutchouc suggests a complexity of 40 isoprene units or more, in the molecules.

Iridescent Cellulose Lacquers

A New Product for the Lacquer-Using Trade

A NEW product which is creating interest in the cellulose lacquer industry is Crec-o-Pearl. An improved technique of manufacture enables a fine grade pearl pigment to be marketed at a figure making its use possible in fancy and decorative high-class cellulose finishes. This remarkable product has the property of imparting an iridescent mother o'pearl finish to cellulose lacquer surfaces which, when skilfully applied, produces effects of surpassing loveliness. Used in small quantities on car body work, an attractive depth of colour obtained, whilst in larger quantities it gives the very pleasing iridescent mother o'pearl effect. Hitherto, its high price has deterred most prospective users.

Crec-o-Pearl is marketed in this country by Rex Campbell and Co., Ltd., who also represent manufacturers of special heat resisting synthetic resins, Crex rewaxed solid dammar, non-toxic substitutes for ordinary hydrocarbon diluents, solvents, oils, synthetic waxes, and allied products for the nitrocellulose lacquer, plastic and allied industries.

THE German-Chilean trade agreement whereby Germany undertakes to allow the duty-free importation of 106,000 metric tons of Chile sodium nitrate (with possibility of increase to 130,000 tons) during the year ending June 30, 1934, provides that 40 per cent. of the profits resulting from the sale of the Chile goods will be placed at the disposal of the Reichsbank, the Reichsbank utilising 20 per cent. for the release of frozen German assets in Chile and the other 20 per cent. for financing sales of German goods to Chile. Distributors of the natural nitrate will be required to continue to adhere to all the requirements governing the German nitrogen fertiliser market as established by the German Nitrogen Syndicate, including schedule of prices, terms, etc., so that there will be no danger of price underbidding or other market disturbance.

News from the Allied Industries

Dyeing

THE BRITISH COTTON AND WOOL DYERS' ASSOCIATION held their annual meeting at Manchester on May 18, when Mr. Fred J. Smith presided. In their section of the dyeing trade, said Mr. Smith, one great obstacle to cheaper production was to be found in the demand of customers for an infinite variety of shades in small quantities. He could not see why this should be altogether necessary, as the resulting difference in the cloth was so small that it was lost or forgotten by the time it came to the retailer. If some arrangement could be made whereby the number of these shades could be reduced their customers would find they would be able to give them an advantage in price which was impossible in present conditions.

China Clay

THE SHIPMENTS OF CHINA CLAY during April though not quite up to the general improvement in the industrial world are very satisfactory. The amount dealt with at the local ports was as follows: Fowsy, 34,608 tons of china clay; 1,133 tons of china stone; 1,997 tons of ball clay. Par, 8,045 tons of china clay; 805 tons of china stone; 111 tons of ball clay. Charlestown, 5,034 tons of china clay; 402 tons of china stone. Penzance, 851 tons of china clay. Padstow, 627 tons of china clay. Looe, 238 tons of china clay. Plymouth, 151 tons of china clay. Newham, 30 tons of china clay. By rail throughout, 14,981 tons of china clay, making a total tonnage of 59,013 tons, compared with 61,155 tons in March, 51,271 tons in February and 60,465 tons in January.

Molasses

IN THEIR INTERIM REPORT the directors of the United Molasses Co., Ltd., say that profits for the six months to March 31, 1934, were sufficient, after making adequate provision for depreciation, to pay the half-yearly dividend on the funded income stock, the income debenture stock and the preference stock, and to pay for £100,020 funded income stock purchased below par for cancellation. During the six months the company has, furthermore, purchased for cancellation £32,218 income debenture stock at a cost, including accrued interest, of £36,043, and, in addition, £300,000 income debenture stock has been drawn for redemption on June 30 next. The improvement in the general trading conditions of the company, referred to in the directors' report last December, continues, but there has lately been a more than seasonal falling off in the demand for molasses, both in the home market and abroad, and present trading conditions are not quite as favourable as they were early in the year.

Rubber

AT AN EXTRAORDINARY GENERAL MEETING of the British Goodrich Rubber Company held on May 23, resolutions changing the name of the company to British Tyre and Rubber Company, and increasing the capital to £2,000,000 were passed.

THE GERMAN DUNLOP RUBBER CO., of Hanau, is paying a dividend for 1933 of 6 per cent. on a share capital of 9,000,000 m.—the first since 1927. Excluding special earnings, the operating surplus is 657,017m. There was a loss of 980,000m. brought forward from previous years, but the company was able to show a net profit of 790,000m. by using special earnings (160,000m.) and a special reserve fund (250,000m.) created for liabilities in foreign currencies. Stocks of finished products and of raw material have been considerably reduced. The turnover shows a substantial increase, but prices are stated to have been favourable, in view of the much higher prices of raw rubber and cotton in 1933. The increase in the latter was nevertheless almost compensated for by the depreciation of the dollar. Business during the current year is described as satisfactory so far. To stimulate sales prices have been lowered considerably, in spite of a further advance in raw material prices since the beginning of 1934.

Non-Ferrous Metals

THE NET PROFIT OF THE INTERNATIONAL NICKEL CO. OF CANADA, for the first quarter of 1934 amounted to $5,049,275.91. After provision for quarterly dividend on the preferred, this profit is equivalent to 31 cents a share on the common stock. It compares with a net loss of $80,158 sustained in the corresponding period a year ago, and with a net profit of $4,026,564.64, or 24½ cents a share, for the final quarter of 1933. Thus the first quarter of the current year has shown a 25 per cent. increase over the preceding quarter. In an accompanying letter to shareholders, Mr. Robert C. Stanley, president of the company, presents a table showing the relative importance of the various markets for nickel. This table indicates the extent to which nickel depends for its markets upon combination with other metals in the production of special alloys for specific uses. Only two categories, representing 27 per cent. of total sales, can be described as being wholly devoted to pure nickel products.

Paint Manufacture

PRESIDING at the third annual meeting of Goodlass Wall and Lead Industries, Ltd., in London on May 10, Mr. Clive Cookson, chairman of directors, said there was evidence, not only in their own trade but in many others, that the large amount of capital at present existing for which no useful outlet could be found was causing the establishment of factories in this country for which, economically, there was no justification. He thought it was possible that that would, in due course, lead to price-cutting and unsatisfactory conditions in many industries. From the national point of view, the only result in the long run was over-capitalisation and loss. The board had so far as possible framed the policy of the company to deal with those possibilities, and, should they occur, he believed that they had taken steps which would reduce their effect to the very minimum. His remarks applied with particular force to the white lead trade at the present time. The existing organisation of production and prices had for some years enabled those engaged in the manufacture, treatment, and distribution of that pigment to make a reasonable profit. The situation had, however, been misunderstood, and several experimental attempts had been made to establish further plants which were, in fact, surplus. Such developments would, of course, lead to a disorganisation of the trade and the loss of capital invested in the new plant. The losses of public money incurred in recent years in such trades as artificial silk were still fresh in their minds, and he would be sorry to see history repeating itself in other directions. He had dwelt on the matter because he believed that the evil of unregulated over-production was, under present financial conditions, likely to increase rather than decrease.

Superphosphate Production in Germany

GERMAN superphosphate production increased in 1933 to 685,000 metric tons from 639,000 in 1932 and a low-record level of only 509,000 tons in 1931. The annual average was 810,000 tons for the four years, 1927-1930. Despite the gains, the German industry has been operating at less than 50 per cent. of capacity and it continues to leave much to be desired from a remunerative point of view. The gains were due primarily to a sharp decline in imports, effected by the trebling of the import duty. The 1933 imports fell to only 51,623 tons, from 137,619 tons in 1932, 134,172 tons in 1931, and 109,437 tons in 1930. Concurrently, there was a further marked decrease in exports of superphosphate, to only 15,416 tons in 1933, from 29,600 tons in 1932 and 51,900 tons in 1931. Imports of basic phosphate slag expanded considerably, to 1,012,530 tons in 1933 from 795,757 tons in 1932. Domestic production also increased during 1933. Exports of basic slag, despite the accelerated domestic output resulting from the augmented activity of the iron and steel industry, declined to only 2,077 tons in 1933, compared with 50,408 tons in 1932 and 173,081 tons and 295,097 tons in 1931 and 1930 respectively.

Continental Chemical Notes

DRY ICE IS NOW BEING MANUFACTURED in Jugoslavia for the first time, by a firm at Semlin.

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LACTIC ACID MANUFACTURE is under consideration by a financial group in Hungary who anticipate a good demand on the part of the leather and textile industries.

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A NEW BELGIAN PIGMENT MANUFACTURING CONCERN has been registered under the name of Les Manufactures Belges des Couleurs d'Outemer, with the object of producing ultramarine and related colours.

* * *

LAST YEAR'S EXPORT OF GREEK ROSIN considerably exceeded that of the previous year. Of the total production of 12,238 tons, 77 per cent. was taken by Italy. A slight increase in the turpentine export is likewise recorded with Italy once again the most important customer.

* * *

UNSATISFACTORY TRADING CONDITIONS prevail among members of hte Czech wood distillation products cartel, which embraces seven producers (vide "Chemische Industrie," May 19) whose outputs are handled by the "Acetic" Company, of Prague. The cartel is due to expire on June 30 of this year.

* * *

MEDICINAL PLANTS ARE NOW CULTIVATED in Jugoslavia on a considerable scale, the haphazard methods of recent years having been abandoned. Italy, the United States and Germany are the most important customers for Jugoslavian pyrethrum, camomile, sage and lime flowers, all of which are exported for the most part in the raw state.

* * *

THE SWISS SANDOZ CONCERN announces improved trading conditions during the past year and is distributing a 20 per cent. dividend as against 18 per cent. for the previous year. Reduced sales to silk dyers were offset by increased activity in the wool and rayon branches. As to future prospects of the Basle works, however, the directors view with grave concern the progressive nationalistic tendency of the chemical industries in various countries.

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THE CARTELLISATION OF THE ACETIC ACID INDUSTRY in Czechoslovakia is reported to be threatened by the establishment of a new factory at Niemes by the merchant house of Lichtenstern and Sametz, as also by the entry into this field of a firm in the vicinity of the Moravian-Czech frontier. Exceptionally large reserves of beech wood are believed to be in the possession of the second newcomer, although for the time being is is only proposed to manufacture sodium acetate.

* * *

A SILICON COMPOUND WITH PYROPHORIC PROPERTIES has been obtained by Andrieus and Doders (" Compt. rend.," 1934, 198,753) by electrolysis of precipitated silica in homogeneous mixture with lithium carbonate in presence of a little lithium chloride and fluoride in a water-cooled carbon crucible. The latter functioned as the cathode. The pyrophoric compound has only been isolated in small yield and burns with a bright flame. The main product of electrolysis under the investigators' conditions was crystalline silicon.

* * *

CONTINUING THEIR INVESTIGATIONS into the origin of carbazole in coke oven tar, Stemart and Schulz have published an account of the pyrogenation of technical phenol mixtures and other constituents of primary tar in the presence of ammonia (" Chimie et Industrie," April, 1934). The tests were carried out in an electrically-heated tube at temperatures ranging from 600° to 1,000° C. and three main fractions were subsequently isolated with distillation ranges of less than 150° C., 150° to 250° C. and 250° to 360° C. respectively. In none of these, however, could any trace of carbazole be detected. In the presence of iron oxide catalyst and at a temperature of less than 650° C. the decomposition occurred with unusual violence and the distillate contained 15 per cent. of hydrocarbons boiling below 185° C.; nor did the pyrolysis of pyridine bases yield any trace of carbazole.

BEECHWOOD DISTILLATION, with a view to isolation of oil products, is being investigated by the Swedish concern of Skanska Attikfabriken, at Perstorp, which has been granted a government loan of 115,000 kronen for this purpose.

* * *

FAVOURABLE RESULTS ARE CLAIMED to have followed experimental cotton cultivation in Hungary, the crop being approximately 3 times as valuable as a grain crop from an equal area.

* * *

PLANS ARE UNDER WAY FOR THE ESTABLISHMENT of a photographic products industry in Bulgaria. The Bafa Company, of Sofia, is about to put into operation a factory for sensitised paper and will extend its activities to other branches of the industry in due course.

* * *

A SIMPLIFIED POTENTIOMETRIC APPARATUS (designed by Roeder) for pH determinations is described by A. Karsten in " Metallbörse," May 16. The apparatus has made a favourable impression in the short time since its introduction, particularly in breweries and dairies.

* * *

AMONG RECENT CONCESSIONS FOR MANUFACTURE granted by the Italian Ministry of Corporations in connection with law limiting new investments in specified industries are a formaldehyde factory and extension of plant for beta-oxynaphthoic acid (Acna S.A.); two safety glass factories in Turin and Milan (Vetro Italiano di Sicurezza); a calcium chloride factory (Ricci Antonio, Cassano Magnago). The Ministry refused permission to erect factories for the manufacture of casein artificial horn, perfumes, oxygen and other gases.

German Potash Negotiations

Two Important Groups of Producers Involved

THE Burbach Kaliwerke A.G., of Magdeburg, which in 1933 again showed a loss of Rm.148,307, after making book profits of Rm.7,819,674, owing to the depreciation of the currencies of its short-term foreign indebtedness, greatly needs financial reorganisation. Apart from long-term obligations of Rm.39,640,000 (which with Rm.36,159,000 consists of the share of the Burbach Company in the British loans of the German Potash Syndicate) there exists a short-term indebtedness of Rm.48,830,000, about half of which had been borrowed with English banks. The share capital of the company, on the other hand, only totals Rm.20,000,000.

According to " The Financial News" negotiations are now afoot with the Wintershall A.G., of Kassel, which has a share capital of Rm.125,000,000, and which produces about 41 per cent. of the German potash output, with regard to a participation of this latter combine in the Burbach Co. The Wintershall Co. has declared itself ready to acquire Rm.6,000,000 new shares of Burbach provided that the latter reduces its share capital from Rm.20,000,000 to Rm.12,000,000 and will subsequently increase it again by Rm.6,000,000 to Reichsmarks 18,000,000. Another condition is that all creditors of the Burbach Co. will reduce their interest to 4 per cent. and prolong their credits for a number of years.

If the negotiations succeed, they would mean the restoration of peace between the two potash groups, Burbach and Wintershall, which up to 1929 were sharp competitors for a leading position. Friendship betweeen the groups would mean that they would control together 55 per cent. of the German potash output, the next strong groups being the Salzdetfurth group with 25 per cent. and the Prussian State group with 13 per cent. Such a consolidation would be a great benefit to this industry in which British capital is largely interested.

During the first four months of 1934 German sales of potash have increased by 120,000 metric tons compared with 1933. Sales for the whole of 1934 are officially estimated at 1,100,000 metric tons, compared with 940,000 metric tons in 1933. In 1928 they aggregated 1,400,000 metric tons.

Weekly Prices of British Chemical Products

Review of Current Market Conditions

A STEADY tone has been maintained during the week, with business on the quiet side owing to the Whitsun holidays, and prices generally have shown little change from last week. Transactions in formaldehyde have been the subject of some keen competition, and increased interest has been noticeable in potassium bichromate and caustic potash. Creosote oil, cresylic acid and refined coal tar have been the most interesting items in the coal tar products section. Business in pitch is still limited and heavy solvent naphtha and xylol are unsatisfactory. There has been limited business in essential oils and steady conditions have been maintained in pharmaceutical products.

LONDON.—Chemical markets have met with the usual interruptions incident to the holiday and with the extended holiday in the north it is not expected the markets will get into proper order until next week. In the meanwhile there are no changes of importance to report, prices continuing practically without change. The coal tar products market is quiet, and prices are unchanged from last week.

MANCHESTER.—The Whitsuntide holidays have effectively put an end to new business in chemical products in Lancashire and the few sellers who were in attendance on the market on the Manchester Royal Exchange this week reported extremely dull conditions. In most of the principal consuming areas works have been closed for about half of the week and in many instances deliveries of chemicals against contracts have been interrupted. Trade should be pretty well in full swing again at the beginning of next week so far as the movement of supplies into consumption is concerned, although it is not expected that there will be much important buying for the present. In the meantime, the undertone of the market continues very steady and in the majority of cases values are nominally unchanged compared with a week ago.

SCOTLAND.—The Whitsun holidays have had the usual effect upon business and as local holidays in Scotland are operating, business generally has been quiet.

General Chemicals

ACETONE.—LONDON: £65 to £68 per ton; SCOTLAND: £66 to £68 ex wharf, according to quantity.

ACID, ACETIC.—Tech. 80%, £38 5s. to £40 5s.; pure 80% £39 5s.; tech., 40%, £20 5s. to £21 15s.; tech., 60%, £28 10s. to £30 10s. LONDON: Tech., 80%, £38 5s. to £40 5s.; pure 80%, £39 5s. to £41 5s.; tech., 40%, £20 5s. to £22 5s.; tech., 60%, £29 5s. to £31 5s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £39 5s.; tech. 80%, £38 5s. d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £39; tech. glacial, £52.

ACID, BORIC.—Granulated commercial, £26 10s. per ton; powder, £28 10s. in 1-cwt. bags d/d free Great Britain in 1-ton lots upwards.

ACID, CHROMIC.—10½d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—LONDON: 9½d. per lb.; less 5%. MANCHESTER: 9½d.

ACID, CRESYLIC.—97/99%, 1s. 8d. to 1s. 9d. per gal.; 98/100%, 2s. to 2s. 2d.

ACID, FORMIC.—LONDON: £45 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £48; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £53; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works, according to district and quality. SCOTLAND: 80°, £23 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: 98/100%, £48 to £50 ex store. MANCHESTER: £48 10s. to £53 ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—LONDON: 1s. per lb. SCOTLAND: B.P. crystals, 11d., carriage paid. MANCHESTER: 1s. 0½d. to 1s. 0¾d.

ALUM.—SCOTLAND: Lump potash, £8 10s. per ton ex store.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—£37 to £45 per ton, carriage paid. LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

ANTIMONY OXIDE.—SCOTLAND: Spot, £26 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden 6½d. to 1s. 1½d. per lb.; crimson, 1s. 3d. to 1s. 5d. per lb., according to quality.

ARSENIC.—LONDON: £16 10s. c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £23 ex wharf. MANCHESTER: White powdered Cornish, £21 ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—£11 per ton.

BARYTES.—£7 to £8 10s. per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot 35/37% £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £8 in 5/6 cwt. casks for contracts over 1934/1935.

BORAX, COMMERCIAL.—Granulated, £15 10s. per ton; powder, £17 packed in 1-cwt. bags, carriage paid any station Great Britain. Prices are for 1-ton lots and upwards.

CADMIUM SULPHIDE.—2s. 7d. to 2s. 11d.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums.

CARBON BISULPHIDE.—£30 to £32 per ton, drums extra.

CARBON BLACK.—3½d. to 5d. per lb. LONDON: 4½d. to 5d.

CARBON TETRACHLORIDE.—£41 to £46 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K. Green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 3¼d. per lb. Liquor, £19 10s. per ton d/d.

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—LONDON: £3 19s. per cwt.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £27 per ton. SCOTLAND: 40%, £28 ex store.

LAMPBLACK.—£45 to £48 per ton.

LEAD ACETATE.—LONDON: White, £34 10s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £33 to £35; brown, £1 per ton less. MANCHESTER: White, £34; brown, £30 10s.

LEAD, NITRATE.—£28 per ton. MANCHESTER: £27 10s.

LEAD, RED.—SCOTLAND: £25 10s. to £28 per ton d/d buyer's works.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £37 10s.

LITHOPONE.—30%, £17 10s. to £18 per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

METHYLATED SPIRIT.—61 O.P. Industrial, 1s. 6d. to 2s. 1d. per gal. Pyridinised industrial, 1s. 8d. to 2s. 3d. Mineralised, 2s. 7d. to 3s. 1d. 64 O.P. 1d. extra in all cases. Prices according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NICKEL AMMONIUM SULPHATE.—£49 per ton d/d.

NICKEL SULPHATE.—£49 per ton d/d.

PHENOL.—8½d. to 9d. per lb. without engagement.

POTASH, CAUSTIC.—LONDON: £42. MANCHESTER: £36 10s.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. net d/d U.K. Discount according to quantity. Ground 5½d. LONDON: 5d. per lb. with usual discounts for contracts. SCOTLAND: 5d. d/d U.K. or c.i.f. Irish Ports. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 99¾/100%, powder, £37. MANCHESTER: £38.

POTASSIUM CHROMATE.—6½d. per lb. d/d U.K.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9¼d. per lb. SCOTLAND: B.P. crystals, 9d. MANCHESTER: Commercial, 8¾d. to 8¾d., according to quantity inh 2-cwt. drums; B.P., 9d. to 9¾d.

POTASSIUM PRUSSIATE.—LONDON: 8¼d. to 8¾d. per lb. SCOTLAND: Yellow spot material, 8¼d. ex store. MANCHESTER: Yellow, 8¼d.

RUPRON (MINERAL RUBBER).—£16 10s. per ton.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels.

SODA ASH.—58% spot, £5 15s. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 10s. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£22 per ton. LONDON: £23.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: Refined recrystallised £10 15s. ex quay or station. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount according to quantity. Anhydrous, 5d. per lb. LONDON: 4d. per lb. net for spot lots and 4d. per lb. with discounts for contract quantities. SCOTLAND: 4d. delivered buyer's premises with concession for contracts. MANCHESTER: 4d. net.

SODIUM BISULPHITE POWDER.—60/62%, £16 10s. per ton d/d 1-cwt. iron drums for home trade.

SODIUM CARBONATE (SODA CRYSTALS).—SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality 7s. 6d. per ton extra. Light Soda Ash £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—£32 per ton.

SODIUM CHROMATE.—4d. per lb. d/d U.K.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £15 ex station, 4-ton lots. MANCHESTER: Commercial, £9 5s.; photographic, £15.

SODIUM META SILICATE.—£16 per ton, d/d U.K. in cwt. bags.

SODIUM NITRITE.—LONDON: Spot, £18 to £20 per ton d/d station in drums.

SODIUM PERBORATE.—LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£12 10s. per ton.

SODIUM PRUSSIATE.—LONDON: 5d. to 5½d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 4¾d. to 5¾d.

SODIUM SILICATE.—140° Tw. Spot £8 per ton d/d station, returnable drums.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d. SCOTLAND: English material £3 15s.

SODIUM SULPHATE (SALT CAKE).—Unground Spot, £3 15s. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 5s.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 2s. 6d. d/d buyer's works on contract, min. 4-ton lots. Spot solid 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.

SODIUM SULPHITE.—Pea crystals spot, £13 10s. per ton d/d station in kegs. Commercial spot, £9 10s. d/d station in bags.

SULPHATE OF COPPER.—MANCHESTER: £14 10s. per ton f.o.b.

SULPHUR.—£10 15s. per ton. SCOTLAND: Flowers, £11; roll, £10 10s.; rock, £9; ground American, £10 ex store.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quality.

SULPHUR PRECIP.—B.P. £55 to £60 per ton according to quantity. Commercial, £50 to £55.

VERMILION.—Pale or deep, 3s. 11d. to 4s. 1d. per lb.

ZINC CHLORIDE.—SCOTLAND: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.

ZINC SULPHATE.—LONDON AND SCOTLAND: £12 per ton.

ZINC SULPHIDE.—11d. to 1s. per lb.

Coal Tar Products

ACID, CARBOLIC.—Crystals, 8½d. to 9d. per lb.; crude, 60's, 2s. 11d. to 2s. 2½d. per gal. MANCHESTER: Crystals, 8d. per lb.; crude, 2s. per gal. SCOTLAND: 60's, 2s. 6d. to 2s. 7d.

ACID, CRESYLIC.—90/100%, 1s. 8d. to 2s. 3d. per gal.; pale, 98%, 1s. 6d. to 1s. 7d.; according to specification. LONDON: 98/100%, 1s. 3d.; dark, 95/97%, 11d. SCOTLAND: Pale, 99/100%, 1s. 3d. to 1s. 4d.; dark, 97/99%, 1s. to 1s. 1d.; high boiling acid, 2s. 6d. to 3s.

ANTHRACENE OIL.—Strained, 4½d. per gal.

BENZOL.—At works, crude, 9d. to 9½d. per gal.; standard motor, 1s. 4d. to 1s. 4½d.; 90%, 1s. 4½d. to 1s. 5½d.; pure, 1s. 7½d. to 1s. 8d. LONDON: Motor, 1s. 6½d. SCOTLAND: Motor, 1s. 6½d.

CREOSOTE.—B.S.I. Specification standard, 3½d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 3d. f.o.r. North; 4d. London. MANCHESTER: 3d. to 4½d. SCOTLAND: Specification oils, 4d.; washed oil, 4¼d. to 4¾d.; light, 4¼d.; heavy, 4¼d. to 4½d.

NAPHTHA.—Solvent, 90/160%, 1s. 6d. to 1s. 7d. per gal.; 95/160%, 1s. 7d. to 1s. 8d.; 99/%, 11d. to 1s. 1d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. SCOTLAND: 90/160%, 1s. 3d. to 1s. 3½d.; 90/190%, 11d. to 1s. 2d.

NAPHTHALENE.—Purified crystals, £9 15s. per ton in bags. LONDON: Fire lighter quality, £3 to £3 10s.; 74/76 quality, £4 to £4 10s.; 76/78 quality, £5 10s. to £6. SCOTLAND: 40s. to 50s.; whizzed, 70s. to 75s.

PITCH.—LONDON: £2 19s. to £3 1s. per ton f.o.b. East Coast port for next season's delivery.

PYRIDINE.—90/140, 6s. 6d. to 7s. per gal.

TOLUOL.—90%, 2s. 3d. per gal.; pure, 2s. 6d.

XYLOL.—Commercial, 2s. 2d. per gal.; pure, 2s. 4d.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex Toluol).—1s. 9¼d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4¼d. per lb. 100% d/d buyer's works.

ACID NAPHTHIONIC.—1s. 8d. per lb.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100% d/d buyer's works.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100% d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZALDEHYDE.—Spot, 1s. 8d. per lb., packages extra.

BENZIDINE BASE.—Spot, 2s. 5d. per lb. 100% d/d buyer's works.

BENZIDINE, HCL.—2s. 5d. per lb.

p-CRESOL 34-5° C.—2s. per lb. in ton lots.

m-CRESOL 98/100%.—2s. 3d. per lb. in ton lots.

DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8d. per lb.

DINITROCHLORBENZENE, SOLID.—£72 per ton.

DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 10½d.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

o-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—Spot, £78 15s. per ton in paper bags; £79 5s. in casks, in 1-ton lots.

α-NAPHTHYLAMINE.—Spot, 11½d. per lb., d/d buyer's works.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb. d/d buyer's works.

o-NITRANILINE.—3s. 11d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 4½d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE P.G.—1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—9½d. per lb.

p-TOLUIDINE.—1s. 11d. per lb.

Wood Distillation Products

ACETATE OF LIME.—Brown, £9 to £10. Grey, £15 to £16. Liquor, brown, 30° Tw., 7d. to 9d. per gal. MANCHESTER: Brown, £12 10s.; grey, £17 10s.

ACETIC ACID, TECHNICAL, 40%.—£17 to £18 per ton.

AMYL ACETATE, TECHNICAL.—95s. to 110s. per cwt.

CHARCOAL.—£5 10s. to £9 10s. per ton.

WOOD CREOSOTE.—Unrefined, 6d. to 9d. per gal.

WOOD NAPHTHA, MISCIBLE.—2s. 6d. to 3s. 3d. jer gal. Solvent, 3s. 9d. to 4s. 6d. per gal.

WOOD TAR.—£2 per ton.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Home: £7 5s. per ton delivered in 6-ton lots to farmer's nearest station. Export: Nominal £5 17s. 6d. per ton f.o.b. U.K. ports in single bags.

CYANAMIDE.—£7 5s. per ton carriage paid to any railway station in Great Britain in lots of 4 tons and over.

NITRATE OF SODA.—£7 18s. 6d. per ton delivered in 6-ton lots to farmer's nearest station.

NITRO-CHALK.—£7 5s. per ton delivered in 6-ton lots to farmer's nearest station.

CONCENTRATED COMPLETE FERTILISERS.—£10 15s. to £11 6s. per ton according to percentage of constituents.

NITROGEN PHOSPHATE FERTILISERS.—£10 5s. to £13 15s. per ton according to percentage of constieuents.

Latest Oil Prices

LONDON, May 23.—LINSEED OIL was firmer. Spot, £23 15s. (small quantities, 30s. extra). June, £22 7s. 6d.; July-Aug., £22 15s.; Sept.-Dec., and Jan.-April, £23, naked. RAPE OIL was quiet. Crude extracted, £28; technical, refined, £29 10s., naked, ex-wharf. COTTON OIL was steady. Egyptian crude, £13 10s.; refined common edible, £16 10s.; and deodorised, £18, naked, ex-mill (small lots 30s. extra). TURPENTINE was steady. American, spot, 47s. 3d. per cwt.

HULL.—LINSEED OIL, spot, quoted £22 17s. 6d. per ton; May, £22 5s.; June-Aug., £22 10s.; Sept.-Dec., £23; Jan.-April, £23 5s., naked. COTTON OIL, Egyptian, crude, spot, £13 15s.; edible, refined, spot, £16; technical, spot, £16; deodorised, £18, naked. PALM KERNEL OIL, crude, f.m.q., spot, £15, naked. GROUNDNUT OIL, extracted, spot, £19 10s.; deodorised, £23 10s. RAPE OIL, extracted, spot, £27; refined, £28 10s. SOYA OIL, extracted, spot, £16; deodorised, £19 per ton. COD OIL, 25s. per cwt. CASTOR OIL, pharmaceutical, 35s. 6d.; first, 30s. 6d.; second, 27s. 6d. per cwt. TURPENTINE, American, spot, 49s. 3d. per cwt.

Inventions in the Chemical Industry

Patent Specifications and Applications

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Accepted with Dates of Application

BENZOIC ACID and benzoates, production.—Bozel-Maletra Soc. Industrielle de Produits Chimiques. Nov. 8, 1932. 409,755.

AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. July 8, 1932. 409,921.

COLOURS OF IRON, or crystallised sulphate of iron or other soluble salts of iron from pyrites cinders, method of manufacturing.—I. De Vecchis. June 29, 1933. 409,936.

TRI-ALKALI PHOSPHATE from ferrophosphorus, manufacture.—W. J. Tennant (Victor Chemical Works). Oct. 3, 1933. 410,001.

PURIFIED CELLULOSE, manufacture.—I. G. Farbenindustrie. Oct. 8, 1932. 410,005.

MIXED HALOGENATED COMPOUNDS for use as di-electric media, manufacture.—Telegraph Condenser Co., Ltd., and F. C. Stephan. Oct. 12, 1933. 410,008.

ZINC METAL, purifying.—New Jersey Zinc Co. Jan. 10, 1933. 410,016.

SATURATING LIQUIDS with carbon dioxide, apparatus.—P. D. E. Molander. Nov. 13, 1933. 410,020.

VAPORISING DEVICE for liquefied gases.—Linde Air Products Co. March 1, 1933. 410,068.

Applications for Patents

SEDIMENTATION APPARATUS.—Dorr-Oliver Co., Ltd., and R. C. Gibbs. May 7. 13780.

TREATMENT OF PAPER-MILL WASTE.—Dorr-Oliver Co., Ltd. May 7. 13781.

STARCH PRODUCTS, manufacture.—Duintjer Wilkens Meihuizen and Co. Naamlooze Vennootschap. May 3. (Austria, May 6, '33.) 13423.

RESINOUS COMPOSITIONS.—E. I. du Pont de Nemours and Co. May 7. (United States, July 24, '33.) 13792.

INSECTICIDAL, ETC., MATERIALS, manufacture.—E. I. du Pont de Nemours and Co. May 7. (Sept. 25, '33.) (United States, Sept. 24, '32.) 13815.

THERAPEUTICALLY-VALUABLE ANTIMONY COMPOUNDS, manufacture. L. S. E. Ellis and Soc. des Usines Chimiques Rhône-Poulenc. May 9. 14045.

CALCINATION OF SILICEOUS PRODUCTS.—P. C. Fassotte. May 3. 13392.

ARYLIDES from 4-hydroxy-diphenyl-3-carboxylic acid, etc.—W. W. Groves and I. G. Farbenindustrie. May 7. 13749.

HIGH-MOLECULAR ACID ANHYDRIDES.—A. Hill, R. Hill and Imperial Chemical Industries, Ltd. May 7. 13811.

COLOURED COMPOUNDS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. May 4. 13524.

AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie and J. Y. Johnson. May 4. 13525.

QUATERNARY AMMONIUM COMPOUNDS of derivatives of anthracene series.—I. G. Farbenindustrie and J. Y. Johnson. May 4. 13526.

ALKYLAMINES, manufacture.—I. G. Farbenindustrie. May 5. 13649.

PHENOLS FROM AQUEOUS SOLUTIONS, recovery.—I. G. Farbenindustrie and J. Y. Johnson. May 7. 13742.

CUPRIFEROUS AZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 3. (Germany, May 3, '31.) 13401.

VAT DYEINGS, production.—I. G. Farbenindustrie. May 4. (Germany, May 6, '33.) 13523.

ACRIDINE DERIVATIVES, manufacture.—I. G. Farbenindustrie H. Mauss and F. Mietzsch. May 4. 13559.

AZO COMPOUNDS, manufacture.—I. G. Farbenindustrie. May 7. 13787.

MONOAZO DYESTUFFS, manufacture.—I. G. Farbenindustrie. May 9. 14043.

THERMOPLASTIC DERIVATIVES OF RUBBER, production.—Imperial Chemical Industries, Ltd. May 3: 13420.

MONOAZO DYESTUFFS, manufacture.—Imperial Chemical Industries, Ltd., and A. H. Knight. May 3. 13421.

TREATMENT OF SOLIDS.—Imperial Chemical Industries, Ltd. May 7. (Holland, May 9, '33.) 13809.

ACENAPHTHENE DERIVATIVES, manufacture.—Imperial Chemical Industries, Ltd., A. Kershaw and M. Wyler. May 7. 13810.

PERFORMING CHEMICAL REACTIONS.—J. B. E. Johnson. May 7. 13724.

PHENOL, production.—L. Kahl, Rutgerswerke A.-G. May 4. (Germany, May 10, '33.) 13567.

CATALYTIC BODIES, preparation.—O. D. Lucas and E. J. Lush. May 3. 13326.

CATALYTIC OXIDATION OF HYDROCARBONS.—O. D. Lucas and E. J. 3. 13327.

VEGETABLE OILS, treatment.—O. D. Lucas and E. J. Lush. May Lush. May 3. 13328.

ACYL OCTAHYDROFOLLICLE HORMONES, production.—Schering-Kahlbaum Akt.-Ges. May 7. (Germany, May 5, '33.) 13788.

PURIFYING CRUDE EXTRACTS of germinal gland hormones.—Schering-Kahlbaum A.-G. May 7. (Germany, May 5, '33.)

From Week to Week

THE NOMINAL CAPITAL of the Chipman Chemical Co., Ltd., 417 Mansion House Chambers, 11 Queen Victoria Street, E.C.4, has been increased by the addition of £2,400 in £1 ordinary shares beyond the registered capital of £100.

MR. ROBERT M'CULLOCH, assistant dyeworks chemist, 149 Irvine Road, Kilmarnock, died in Kilmarnock Infirmary last week as the result of an accident in John Finnie Street, where he was knocked down by a motor car.

THE TEXT OF THE AGREEMENT between the Governments of France, the United Kingdom, India, the Netherlands and Siam to regulate the production and export of rubber has been issued by the Stationery Office (Cmd. 4583, 3d. net).

THE AYRSHIRE DEVELOPMENT COUNCIL are organising an industrial exhibition to be held at Beresford Park, Ayr, from June 9 to June 23, when manufacturers will unite in presenting a display of the country's industrial resources. The exhibits already arranged include the manufacture of chemicals, soaps, etc.

THE WALL PAPER MANUFACTURERS, LTD., announce that they have acquired certain other wallpaper manufacturing and allied businesses. Information as to the acquisition with details of the increase of capital necessitated will be submitted to the stockholders in due course.

A MEETING OF THE SHAREHOLDERS of Langdales Chemical Manure Co., Newcastle-on-Tyne is to be held on June 12, when the directors will recommend that the assets of the company should be sold to Northern Fertilisers, Ltd. It is estimated that £85,020 will be available for distribution among the shareholders when the deal is completed.

THE BRITISH OIL AND GUANO CO. reports a total debit balance of £2,865 at March 31, 1934. An extraordinary meeting will be held in Edinburgh on June 6 to consider voluntary liquidation.

CHILEAN COLLIERY OWNERS are expecting to reap rich benefits from British research into the hydrogenation of coal. The Government has cabled instructing its Embassy in London to follow carefully these experiments and to report further discoveries.

WHILE POST OFFICE TELEPHONE LINESMEN were at work in an underground chamber on the Fair Green, Mitcham, last week, a cylinder of carbide was accidentally dropped and fell into the sump water at the bottom of the chamber, causing an explosion. Edward Gates, 35, of South Park Road, Wimbledon, who was working in the chamber, was injured.

MR. J. T. MILNES, of Lymm, whose death was announced on May 15, was a prominent figure in the oil trade. He was for many years connected with Young's Paraffin Light and Oil Co., Ltd., of Glasgow, which was absorbed by the British Petroleum Co. In early life he was associated with the late Dr. Young, of Glasgow, the inventor of many processes relating to the extraction of oil from shale.

SURPRISE HAS BEEN CAUSED in Norwegian whaling circles by the announcement that one of the largest groups of the Norwegian Whaling Companies—namely, the group headed by Herr Lars Christensen, of Sandefjord—had made a separate agreement with Unilever, Ltd. Under the agreement, it is reported, Unilever, Ltd., has promised to buy the total production of whale oil of the said companies up to a maximum of 110,000 tons annually.

RHODES, BRYDON AND YOUATT, LTD., Stockport, have been appointed sole agents and distributors in Great Britain for Sihi self-priming water pumps, vacuum pumps and compressors.

PRODUCTION OF SYNTHETIC ORGANIC DYESTUFFS in the United Kingdom in 1933 amounted to 52,944,866 lb., as compared with 49,380,266 lb. in 1932 and 48,621,073 lb. in 1931.

MR. ERNEST E. KNIGHT, agent for potters' materials, Albion Street, Hanley, announces that owing to his premises being required by the owners for their own occupation, his business address is now 28 Howard Place, Shelton, Stoke-on-Trent.

THE APPEAL FOR FUNDS to purchase the Rothamsted fields has secured, in cash or good promises, the £10,000 necessary to claim the donations of £15,000 by Mr. Robert McDougall and £5,000 by the Sir Halley Stewart Trust. The success of the purchase scheme is therefore assured.

DAMAGE ESTIMATED AT £1,000 was caused by fire at Liphill Bank Chemical Works, near Holmfirth, on May 18. The fire, which is believed to have started in the boiler-house of the works, was put out by Holmfirth Fire Brigade, who arrived within five minutes of receiving a call. To obtain water they banked up an adjacent stream, from which they obtained sufficient pressure for several jets.

MR. J. PERCY PLANT has been elected chairman of the board of management of the Birmingham section of the 1935 British Industries Fair in succession to Mr. C. E. Greener. Although it is just over twelve months until the Birmingham section of the Fair opens, the response from last year's exhibitors has been very impressive. Of the 264,000 sq. ft. available, applications have been received for nearly 70 per cent. This is better than the corresponding period last year when, of course, there was not such a long period before the opening. The change of date has only brought seventeen refusals, equivalent to 0.2 per cent., to the offices of the Birmingham section. An interesting feature is the usual number of exhibitors asking for increased space; in fact, almost exactly 25 per cent. of the applications have been for bigger sites.

FOUR BOYS HAVE DIED as a result of a scalding accident at the Heaton Mills Bleaching Co.'s works near Middleton, outside Manchester, on May 17. They were James Thurle, 14, of Boardman Street; James Ward, 14, of Thorpe Street; Fred Hardman, 14, of Chapel Street; and James Parker, 15, of Chapel Street, all of Rhodes. It is understood that Ward and Parker were teaching the other two boys, and they were all trapped in a stream of boiling bleach liquid when they were working close to a bleaching kier. The kier is a tank containing liquid, at a very high temperature, through which grey cloth is passed in the process of bleaching. The liquid began to escape during the process known as "plaiting down," a work on which two boys are usually engaged.

AN OPEN VERDICT was returned at an inquest at Widnes last week on William Kay, aged 30, a chemical revolver mixer employed at the Gaskell-Marsh works of Imperial Chemical Industries, Ltd., who died in hospital following injuries received at the works on April 29. The evidence showed that Kay and another man were on a high level landing, placing a bogie on a hoist, when the hoist moved and caused the bogie to strike Kay and fracture his spine. The hoist driver told the coroner that he set the hoist in motion in obedience to the usual bell signal. Mr. T. H. Hunt, Inspector of Factories, stated that the company was considering the erection of an entirely new hoist of modern pattern. He understood there would be a different method of signalling, by electricity control and lights. In the present instance no one knew how the bell was rung.

THE SEVENTH ANNUAL MEETING of the John Benn Hostel and Milner Hall was held on May 10. Mr. H. Eric Miller, who presided in the absence of Sir Ernest Benn, in moving the adoption of the accounts said the deficiency for the year was £670, compared with a larger figure the previous year, but that was a book entry as they had written £800 off the premises and thus had come through the year with something to their credit. There was now practically no unemployment amongst the boys. Mr. Gordon Robbins seconded the motion, which was carried unanimously. The Mayor of Stepney (Councillor R. J. Woodham), in moving the re-election of Miss E. Benn, Mr. J. H. Harris, Dr. Cyril Burt, Mrs. A. R. Pain and Mr. Gordon Robbins as members of the council, said money could not be better spent than in the work of the Hostel. Mr. G. D. R. Butler, in seconding, referred to the position of the boys under the new Unemployment Bill. The position of the boys, if they should fall out of work, would not be satisfactory, and consideration might be given to the question of co-ordinating the work of the L.C.C. and the Ministry of Labour. Mr. F. Faulkner, an old boy, said he had been impressed by the fact that the system in the hostel was for Mr. Townshend to suggest matters to the older boys. They carried out the suggestions and the younger boys followed their lead. It was better than any form of discipline. The chairman said it was the first time an old boy had spoken at the annual meeting, and he hoped it would not be the last.

REPORTS HAVE REACHED CALCUTTA FROM ENGLAND that a shortage of shellac is threatened because there is none in Calcutta and damage and dust in Bihar will interfere with the crop. Shellac dealers at Calcutta call this a preposterous report. They say that Calcutta for six months has been shipping at twice the normal rate owing to the operations of a big London syndicate, and it is expected that this activity will continue for three months more. There is no truth in the rumour about damaged crop. Official inspection reports anticipate a good crop. The Baisa crop is expected to be normal. Shellac from this district is coming into Calcutta at the rate of 100 tons daily.

THE SHAWINIGAN WATER AND POWER CO. has put into operation a new 160,000 horse-power hydro-electric plant at Rapide Blanc, Quebec. This is the first of a series of developments in Northern Quebec designed to yield eventually about 1,000,000 horse-power, and has been completed more than a year ahead of the original schedule. The company now has available from its own power plants a capacity of 809,200 electrical horse-power and 55,000 hydraulic horse-power, in addition to 110,000 horse-power purchased from other companies. Produced at a low cost, this power is used by practically all industries in Quebec.

Company News

"Shell" Transport and Trading Co.—A dividend of 7½ per cent. is announced, tax free, on the ordinary shares, payable on July 6.

Royal Dutch Petroleum Co.—A dividend of 6 per cent. is announced.

A. B. Fleming & Co.—A final dividend of 6 per cent. has been declared, making 11 per cent. for the year, against 10 per cent. in the previous year.

Bell Brothers (Manchester, 1927).—A trading loss of £986 is reported for the twelve months to March 31 last. There was a total debit balance of £3,854, to which is added £1,189 brought forward, making a total debit balance of £5,044.

Solidol Chemical Co.—The accounts for the fifteen months to December 31, 1933, show a net loss of £9,646, against a loss of £3,844 in the previous year. The debit brought forward was £4,876, making a total debit to be carried forward of £14,522.

British Alkaloids, Ltd.—The profit for the year to March 31 was £10,174, out of which £300 is written off preliminary expenses, £4,850 off advertising account, and £2,200 is reserved for taxation. After providing for the 8 per cent. preference dividend, it is proposed to pay a maiden dividend of 2½ per cent. on the ordinary shares, £739 (against £733) going forward.

B. Laporte, Ltd.—The profit for the year ended March 31 last, including dividends and interests received from investments, after charging directors' fees, making provision for depreciation and doubtful debts, and providing a sum for obsolescence, amounts to £69,410, to which is added the balance of profit and loss account brought forward from last account, £18,182, making a total of £87,592. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. for the year ended March 31, 1934, less income tax; a bonus on the ordinary shares at the rate of 5 per cent. for the year, less income tax; to place to directors' special remuneration, £1,000; transfer to general reserve fund, £15,000; transfer to investments reserve account, £5,000; write off goodwill, £3,499; transfer to incometax suspense account, £11,000; transfer to pension and benevolent fund, £3,000. The amount carried forward is £17,270.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

South Africa.—The British Trade Commissioner at Johannesburg reports that the City of Johannesburg is calling for tenders, to be presented in Johannesburg by June 23, 1934, for the supply, delivery and erection of (a) 1 Tar or bitumen mixing plant, gas heated furnace, giving an output of 10/15 tons per hour, and housing hopper, runway motor, and starter; (b) 4 400-gallon capacity stationary gas heated bitumen boilers with thermostat control, erected complete; 1 800-gallon capacity stationary gas heated bitumen boiler with thermostat control, erected complete. (Ref. G.Y. 13818.)

Argentina.—The Commercial Counsellor to H.M. Embassy at Buenos Aires reports that the Argentine State Oilfields are calling for tenders, to be presented in Buenos Aires by June 18, 1934, for the supply and delivery of four centrifugal pumps capable of an output of not less than 50 cubic metres of water per hour to a minimum head of ten metres, each coupled direct to a three-phase a.c. motor operating on a 220 volt 50 cycle supply. (Ref. G.Y. 13827.)